

TECHNICAL MANUAL
OPERATOR AND ORGANIZATIONAL
MAINTENANCE MANUAL
GRADER, ROAD, MOTORIZED, DED, TYPE 1
6 WHEEL, 4 WHEEL DRIVE,
FRONT WHEEL STEERING,
12-FOOT BLADE,
CATERPILLAR MODEL 120
FSN 3805-466-0084

HEADQUARTERS, DEPARTMENT OF THE ARMY

MARCH 1971

This copy is a reprint which includes current

changes from Change 2

WARNING

Take particular heed to specific cautions and warnings throughout this manual.

Disconnect the battery ground cable before removing and installing components on engine or in electrical system.

Utilize extreme caution, do not smoke, or use open flame in vicinity when servicing batteries.

Operator And Organizational Maintenance Manual
GRADER, ROAD, MOTORIZED, DED, TYPE-1
6-WHEEL, 4-WHEEL DRIVE, FRONT WHEEL STEERING,
12-FOOT BLADE, CATERPILLAR MODEL 120

NSN 3805-00-466-0084

TM 5-3805-249-12, 10 March 1971, is changed as follows:

Inside front cover, add the following:

When inflating tire, turn the locking ring away from any person nearby to prevent injury if the ring should fly off.

Keep transmission and clutch engaged when descending a steep grade.

Do not make sharp turns at high speeds.

Do not run engine inside a closed area without proper ventilation. Exhaust gases are poisonous.

Never attempt to clean, oil, or adjust a machine while it is in motion.

Use extreme care when removing radiator cap to avoid being scalded.

Page 1-1.

Paragraph 1-3, Equipment Serviceability Criteria is deleted.

Paragraph 1-4 is superseded as follows:

1-4. Reporting Errors and Recommending Improvements

You can help improve this manual. If you find any mistake or know of a way to improve the procedures, please let us know. Mail your DA FORM 2028 (Recommended Changes to Publications and Blank Forms) direct to: Commander, US Army Tank-Automotive Material Readiness Command, ATTN: DRSTA-MBP, Warren, Michigan 48090. A reply will be furnished direct to you.

Page 1-3. Paragraph 1-7a line 2 change "nine" to read "ten".

Subparagraph (1) is superseded as follows:

(1) The Army data plate, located on the left exterior of the operator's compartment, gives the model, contract registration, and serial number.

Following subparagraph (9), add the following:

(10) The transportation data plate is located on the left exterior of the operator's compartment. It gives dimensions, weights, and tiedown information.

Page 1-4. Paragraph 1-7b(11), line 3 change "Belt" to read "Gear".

Page 1-5. Paragraph 1-7b(30), line 1 change "75 gal" to read "70 gal".

Page 2-1. Following paragraph 2-1g add paragraph h and table 2-1.

h. Maintenance and operating supplies for the initial 8 hours of operation for the road grader are contained in table 2-1.

Page 2-6. Following paragraph 2-9c(11), add "(12) Disconnect switch".

Page 2-7. Figure 2-11, add "leader" and "12" to switch at left of driver's seat.

Legend, for figure 2-1 add "12 Disconnect switch".

Page 2-8. Paragraph 2-9e(2) is superseded as follows:

(2) The air cleaner indicator indicates when the air cleaner must be serviced.

It is mounted on the interior to the right on the operator's seat.

application	stock number	Description	for initial operation	for 8 hours operation	
Crankcase		OIL, LUBRICATING, ENGINE; 55 gal drum as follows:			(1) Includes quantity of oil to fill engine oil system as follows:
	9150-00-680-1104 (2)	HDO—30	22 qts	(3)	20 qts engine crank-
	9150-00-680-1105 (2)	HDO—10	22 qts	(3)	case
	9150-00-242-7605 (2)	OES	22 qts	(3)	2 qts oil filter
Bladelift control		OIL, LUBRICATING, GEAR; 55 gal drum as follows:			(2) See C9100-IL for additional data and requisitioning pro-
	9150-00-577-5846 (2)	GO—90	2 qts ea	(3)	cedure.
	9150-00-257-5443 (2)	GOS	2 qts ea	(3)	(3) See current LO for grade application and replenishment inter-
Brake master cylinder		BRAKE FLUID, AUTOMOTIVE; 1 gal can as follows:			vals.
	9150-00-231-9071 (2)	HB	1 qt	(3)	(4) Tank capacity.
Circle center shift		OIL, LUBRICATING GEAR;			(5) Average Fuel con-
	9150-00-577-5846	GO—90	1 qt (6)	(3)	sumption is 4 gal
	9150-00-257-5443	GOS	1 qt (6)	(3)	per hour of contin-
Circle reverse control		OIL, LUBRICATING, GEAR;			uous operation.
	9150-00-577-5846	GO—90	1 1/2 qts (6)	(3)	(6) Use oil as pre-
	9150-00-257-5443	GOS	1 1/2 qts (6)	(3)	scribed for blade lift control.
Fuel tank		DIESEL FUEL, bulk as follows:			(7) Use oil as pre-
	9140-00-286-5294 (2)	DF2 Regular	75 gals (4)	28 gals (4)	scribed for engine
	9140-00-286-5286 (2)	DF1 Winter	75 gals (4)	28 gals (5)	
	9140-00-286-5283 (2)	DF A Arctic	75 gals (4)	28 gals (5)	
Grease points		GREASE, AUTOMOTIVE AND ARTILLERY; 5 lb can as follows:			
	9150-00-190-0905	GAA	5 lb	(3)	
Hydraulic system		OIL, LUBRICATING, ENGINE; 55 gal drum as follows:			
	9150-00-265-9430 (2)	OE—10	18 qts	(3)	
	9150-00-242-7605 (2)	OES	18 qts	(3)	
Lean wheel control		OIL, LUBRICATING, GEAR			
	9150-00-577-5846	GO—90	1 1/2 qts (6)	(3)	
	9150-00-257-5443	GOS	1 1/2 qts (6)	(3)	
Power control housing		OIL, LUBRICATING, GEAR			
	9150-00-577-5846	GO—90	8 qts (6)	(3)	
	9150-00-257-5443	GOS	8 qts (6)	(3)	
Power control shaft and gear housing		OIL, LUBRICATING, GEAR			
	9150-00-577-5846	GO—90	1 1/2 qts (6)	(3)	
	9150-00-257-5443	GOS	1 1/2 qts (6)	(3)	
Rear axle housing		OIL, LUBRICATING, GEAR			
	9150-00-577-5846	GO—90	37 qts	(3)	
	9150-00-257-5443	GOS	37 qts	(3)	

Table 2-1. Maintenance and Operating Supplies—continued

(1) Component application	(2) National stock number	(3) Description	(4) Quantity required for initial operation	(5) Quantity required for 8 hours operation	(6) Notes
Radiator	6850-00-181-7940 6850-00-174-1806	ANTIFREEZE; 55 gal drum as follows: ANTIFREEZE: Ethylene Glycol ANTIFREEZE: Compound Arctic	26 qts 44 qts		
Scarifier upper housing	9150-00-577-5846 9150-00-257-5443	OIL, LUBRICATING, GEAR GO—90 GOS	6 1/2 qts ea (6) 6 1/2 qts ea (6)	(3) (3)	
Scarifier lower housing	9150-00-577-5846 9150-00-257-5443	OIL, LUBRICATING, GEAR GO—90 GOS	1 qt 1 qt	(3) (3)	
Steering gear housing	9150-00-680-1104 9150-00-680-1105 9150-00-242-7605	OIL, LUBRICATING, ENGINE HDO-30 HDO-10 OES	3/4 qt (7) 3/4 qt (7) 3/4 qt (7)	(3) (3) (3)	
Tandem drive housing	9150-00-577-5846 9150-00-257-5443	OIL, LUBRICATING, GEAR GO—90 GOS	24 qts ea (6) 24 qts ea (6)	(3) (3)	
Transmission and flywheel clutch	9150-00-265-9436 (2) 9150-00-265-9430 (2) 9150-00-242-7605 (2)	OIL, LUBRICATING, ENGINE OE-30 OE-10 OES	80 qts 80 qts 80 qts	(3) (3) (3)	
Transfer gear housing	9150-00-577-5846 9150-00-257-5443	OIL, LUBRICATING, GEAR GO—90 GOS	1/3 qt (6) 1/3 qt (6)	(3) (3)	

Page 2-9. Paragraph 2-11b subparagraph (1) is superseded as follows:

(1) Apply the parking brake. Place the transmission shift lever (9, fig. 2-11) in the NEUTRAL position.

Paragraph 2-12a(16) is superseded as follows:

(6) Pull the main disconnect switch up and turn to OFF. Position the cover over the switch and secure with padlock if desired.

Paragraph 2-12b(2) is superseded as follows:

(2) Always use the correct shift lever.

There isn't much of it, but you have to keep it up. The forms and records you fill out have several uses. They are a permanent record of the services, repairs, and modifications made on your equipment; they are reports to organizational maintenance and to your commander; and they are a checklist for you when you want to know what is wrong with the equipment after its last use, and whether those faults have been fixed. For the information you need on forms and records, see TM 38-750.

3-5. Preventive Maintenance Checks and Services

a. Do your (B) PREVENTIVE MAINTENANCE just before you operate the grader. Pay attention to the CAUTIONS AND WARNINGS.

b. Do your (D) PREVENTIVE MAINTENANCE during operation. (During operation means to monitor the grader and its components, such as the instruments while they are actually being operated).

c. Do your (A) PREVENTIVE MAINTENANCE right after operating the grader. Pay attention to the CAUTIONS AND WARNINGS.

d. Do your (W) PREVENTIVE MAINTENANCE weekly.

e. Do your (M) PREVENTIVE MAINTENANCE once a month.

f. If something doesn't work, troubleshoot it with the instructions in this manual or notify your supervisor.

g. Always do your preventive maintenance in the same order, so it gets to be a habit. Once you've had some practice, you'll spot anything wrong in a hurry.

h. If anything looks wrong and you can't fix it, write it on your DA Form 2404. If you find something seriously wrong, report it to organizational maintenance RIGHT NOW.

i. When you do your preventive maintenance, take along the tools you need to make all the checks. You always need a rag or two.

WARNING

Drycleaning solvent SD-2, used to clean parts, is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 138° F.

(1) *Keep it clean.* Dirt, grease, oil, and debris only get in the way and may cover up a serious problem. Clean as you work and as needed. Use drycleaning solvent (SD-2) to clean metal surfaces.

(2) *Bolts, nuts, and screws.* Check that they are not loose, missing, bent, or broken. You can't try them all with a tool, of course, but look for chipped paint, bare metal, or rust around bolt heads. If you find one loose, tighten it or report it to organizational maintenance.

(3) *Welds.* Look for loose or chipped paint, rust, or gaps where parts are welded together. If you find a bad weld, report it to organizational maintenance.

(4) *Electric wires and connectors.* Look for cracked or broken insulation, bare wires, and loose or broken connectors. Tighten loose connectors and make sure the wires are in good condition.

(5) *Hoses and fluid lines.* Look for wear, damage, and leaks. Make sure clamps and fittings are tight. Wet spots show leaks, of course, but a stain around a fitting or connector can also mean a leak. If a leak comes from a loose fitting or connector, tighten it. If something is broken or worn out, report it to organizational maintenance.

j. It is necessary for you to know how fluid leakage affects the status of your equipment. The following are definitions of the types/classes of leakage you need to know to be able to determine the status of your equipment. Learn and be familiar with them and REMEMBER — When in doubt, notify your supervisor!

Leakage Definitions for Operator/Crew PMCS

- | | |
|-----------|----------------------------------------------------------------------------------------------------------------------|
| CLASS I | Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops. |
| CLASS II | Leakage of fluid great enough to form drops but not enough to cause drops to drip from item being checked/inspected. |
| CLASS III | Leakage of fluid great enough to form drops that fall from the item being checked/inspected. |

CAUTION

Equipment operation is allowable with minor leakage (Class I or II). Of course, consideration must be given to the fluid capacity in the item/system being checked/inspected. When in doubt, notify your supervisor.

When operating with Class I or II leaks, continue to check fluid levels as required in your PMCS.

Class III leaks should be reported to your supervisor or to organizational maintenance.

Page 3-1. Table 3-1 is superseded as follows:

Item no.	Interval					ITEM TO BE INSPECTED Procedure: Check for and have repaired, filled, or adjusted as needed	Equipment is not ready/available if:
	B	D	A	W	M		
						<p align="center">NOTE</p> <p>PERFORM WEEKLY AS WELL AS BEFORE PMCS's IF:</p> <p><i>a.</i> You are the assigned driver but have not operated vehicle since the last weekly.</p> <p><i>b.</i> You are operating the vehicle for the first time.</p> <p>MAKE THE FOLLOWING WALK AROUND CHECKS:</p> <p>EXTERIOR OF VEHICLE</p> <p><i>a.</i> Check for evidence of leakage (oil, fuel, hydraulic fluid, or coolant) on or under the grader.</p> <p><i>b.</i> Check tires for damage or low pressure (correct pressure is 35 psi for front tires and 28-30 psi for rear tires).</p> <p><i>c.</i> Check moldboard and scarifier for excessively worn, missing, and broken cutting edges and/or teeth.</p> <p><i>d.</i> Visually check Roll Over Protective Structure (ROPS) for cracked welds, buckled or split seams, and loose or missing mounting bolts.</p> <p><i>e.</i> Check that fire extinguisher is in proper place and has proper pressure. Needle on gage should be in white area.</p> <p><i>f.</i> Visually check for loose, missing, or damaged parts.</p> <p><i>g.</i> Visually check lights for broken lens and accumulation of foreign materials detracting from visibility.</p> <p>RADIATOR</p> <p>Check coolant level. Level should be maintained to the bottom of the fill pipe.</p> <p>AIR CLEANER</p> <p>Check indicator during operation. Service when red band is showing.</p> <p>INSTRUMENTS</p> <p>Check for normal operating readings for the instruments.</p> <p><i>a.</i> Ammeter 0 (or slight +).</p> <p><i>b.</i> Engine oil press 20 to 40 psi.</p> <p><i>c.</i> Water temp 160° to 227°F.</p> <p><i>d.</i> Trans oil press 200 to 250 psi.</p> <p><i>e.</i> Fuel press 17 to 28 psi.</p> <p>BATTERIES</p> <p><i>a.</i> Check level of electrolyte. If low, fill with clean water (distilled if possible) to the split ring. In freezing weather, run engine at least 15 minutes after adding water.</p> <p><i>b.</i> Inspect for cracks and leaks. Inspect cables for clean and tight connections.</p> <p>V-BELTS</p> <p>Inspect fan and alternator belts for looseness, frayed condition, or deterioration.</p> <p>HYDRAULIC BRAKE MASTER CYLINDER</p> <p>Check fluid level. Add fluid to maintain level 1/2 inch below filler opening.</p> <p>HYDRAULIC TANK</p> <p>Check hydraulic oil level. Oil should be visible in filler opening. Add oil as required.</p> <p>ENGINE OIL LEVEL</p> <p>With the grader level and engine running at normal operating temperature (160-227°F), check oil level</p>	<p>Class III leaks or any fuel leakages.</p> <p>Tires have cuts or abrasions which would result in tire failure during operation.</p> <p>One or more tires missing or unserviceable.</p> <p>Missing, broken, or cracked cutting edges.</p> <p>Cracked welds, buckled or split seam, and loose or missing mounting bolts.</p> <p>Pressure/temperature gages not within ranges specified.</p> <p>Belt missing or broken.</p>
1	●						
	●						
	●						
2	●						
3		●					
4	●						
	●						
	●						
	●						
5					●		
					●		
6					●		
7					●		
8	●						
9		●					

Page 3-2. Table 2, item 10 is superseded as follows:
(10) Blade sideshift and steering does not operate.

Following item 10, add the following:

(11) Malfunction; Blade Controls do not operate. Probable cause; Broken shear pin. Corrective Action; Replace shear pin.

Page 3-5. Paragraph 3-11b(1) is superseded as follows:

(1) Loosen eyebolts (17) and remove the air cleaner cover (18) and the primary element (19).

Figure 3-4, Change callout "5" to read callout "22".

Legend for figure 3-4. Following item 21 add "22 Clamp". Delete "5 Clamp".

Page 3-6. Paragraph 3-11b(6) is superseded as follows:

(6) Install clean element air cleaner cover and tighten eyebolts. Reset the air cleaner indicator.

Paragraph 3-11c(1) is superseded as follows:

(1) Loosen eyebolts (17). Remove the air cleaner cover (18), primary element (19) and nuts (not shown), and secondary element (20). Cover the air inlet openings.

Paragraph 3-11c(5) is superseded as follows:

(5) Install the primary element (19) and the air cleaner cover (18) and tighten eyebolts (17).

Paragraph 3-16a is superseded as follows:

a. To check the oil level, start the engine and

with the transmission in NEUTRAL, remove the dipstick (fig. 3-5). Level should be at the FULL mark on the gage.

Page 3-7. Figure 3-6 change "LEVEL PLUG" to read "DRAIN PLUG".

Page 3-8. Paragraphs 3-20a and 3-20b are deleted.

Page 3-9. Paragraph 3-22, second sentence is changed to read as follows:

Check tires for cuts, leaks, and wear. Air pressure should be 35 psi front, 28-30 psi rear, with tires cold. Repairs may be accomplished on equipment using tire repair kit NSN 4910-00-922-6921.

Paragraph 3-23a change "ware" to read "warm"

Page 3-10. Paragraph 3-25. Add the following after line 3. Loss of power to blade scarifier, steering or leaning wheel indicates shear pin failure. To replace shear pin, remove nut securing shaft cover, align holes in shaft and pump, and insert new shear pin through shaft and pump drive. Install cover and secure.

NOTE

Bag of extra shear pins are provided in toolbox.

Page 4-1. Section IV is superseded as follows:

Section IV. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

4-5. General

To insure that the grader is ready for operation at all times, it must be inspected systematically so that defects may be discovered and corrected before they result in serious damage or failure. Table 4-1 contains a tabulated listing of preventive maintenance personnel. All deficiencies and shortcomings will be recorded as well as the corrective action taken on DA Form 2404 at the earliest possible opportunity.

4-6. Organizational Preventive Maintenance Checks and Services

a. The item numbers of table 4-1 indicate the sequence of the PMCS. Perform at the intervals shown below:

(1) Do your (Q) PREVENTIVE MAINTENANCE once each 3 months.

(2) Do your (S) PREVENTIVE MAINTENANCE twice a year, or each 6 months.

(3) Do your (A) PREVENTIVE MAINTENANCE

(6) Do your (MI) PREVENTIVE MAINTENANCE when the mileage of grader reaches the amount listed.

b. If something doesn't work, troubleshoot it with the instructions in this manual or notify your supervisor.

c. Always do your preventive maintenance in the same order, so it gets to be a habit. Once you've had some practice, you'll spot anything wrong in a hurry.

d. If anything looks wrong and you can't fix it, write it down on your DA Form 2404. If you find something seriously wrong, report it to direct support as soon as possible.

WARNING

Drycleaning solvent SD-2, used to clean parts, is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 138°F.

Use soap and water when you clean rubber or plastic material.

(2) *Bolts, nuts, and screws.* Check that they are not loose, missing, bent, or broken. You can't try them all with a tool, of course, but look for chipped paint, bare metal, or rust around bolt heads. Tighten any that you find loose.

(3) *Welds.* Look for loose or chipped paint, rust, or gaps where parts are welded together. If you find a bad weld, report it to direct support.

(4) *Electric wires and connectors.* Look for cracked or broken insulation, bare wires, and loose or broken connectors. Tighten loose connections and make sure the wires are in good condition.

(5) *Hoses and fluid lines.* Look for wear, damage, and leaks. Make sure clamps and fittings are tight. Wet spots show leaks, of course, but a stain around a fitting or connector can mean a leak. If a leak comes from a loose fitting or connector, tighten it. If something is broken or worn out, either correct it or report it to direct support (refer to MAC chart, appendix B).

e. It is necessary for you to know how fluid leaks affect the status of your equipment. The following are definitions of the types/classes of leakage you need to know to be able to determine the status of your equipment. Learn and be familiar with them and REMEMBER — When in doubt, notify your supervisor!

Leakage definitions for Organizational PMCS

CLASS I Seepage of fluid (as indicated by wetness, or discoloration) not great enough to form drops.

CLASS II Leakage of fluid great enough to form drops but not enough to cause drops to drip from the item being checked/inspected.

CLASS III Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

CAUTION

Equipment operation is allowable with minor leakages (Class I or II). Of course, consideration must be given to the fluid capacity in the item/system being checked/inspected. When in doubt, notify your supervisor.

When operating with Class I or II leaks, continue to check fluid levels as required in your PMCS.

Class III leaks should be corrected before releasing equipment for operation.

Page 4-2. Table 4-1. is superseded as follows:

Table 4-1. Organizational Preventive Maintenance Checks and Services

							Legend		
							Q-Quarterly S-Semiannually	A-Annually B-Biennially	H-Hours MI-Miles
Item no.	Interval						ITEM TO BE INSPECTED Procedure		
	Q	S	A	B	H	MI			
NOTE									
PERFORM OPERATOR/CREW PMCS PRIOR TO OR IN CONJUNCTION WITH ORGANIZATIONAL PMCS.									
1							BLADE ASSEMBLY		
	●						a. Inspect moldboard, cutting edge, and end bits. Replace when cutting edge is worn to within approximately 3/4 inch of moldboard.		
	●						b. Inspect blade, side-shift cylinder, and lines for leaks.		
2	●						SCARIFIER, CIRCLE LIFT LINKS		
							Inspect ball and sockets for excessive clearance. Remove shims as necessary to eliminate looseness.		
3							CIRCLE CENTER SHIFT MECHANISM		
	●						a. Inspect pinion and gear rack for damage. Inspect wear plates for excessive clearance.		
	●						b. Inspect circle drawbar, ball and socket for damage.		

Table 4-1. Organizational Preventive Maintenance Checks and Services—continued

Item no.	Interval						ITEM TO BE INSPECTED Procedure
	Q	S	A	B	H	MI	
							NOTE The leaning wheel, circle reverse, circle center shift, and scarifier controls have drive shafts and universal joints which are similar.
6	●						DRIVE SHAFTS AND UNIVERSAL JOINTS Inspect for loose mountings, wear, and damage. Replace if damaged.
7						100	ENGINE <i>a.</i> Change oil and filters. <i>b.</i> Inspect oil cooler and lines for secure mountings and leaks. <i>c.</i> Inspect water pump, hoses, and pipes for leaks. <i>d.</i> Inspect V-belts for damage. Check for proper adjustment. Correct adjustment is 3/4 to 1 inch deflection midway between pulleys. <i>e.</i> Check for leaks, loose mounts., and proper operation. <i>f.</i> Change fuel filter when fuel pressure gage reads zero with engine running. <i>g.</i> Check valve adjustment. (1) Intake .015 (2) Exhaust .025
8	●			●			FUEL INJECTOR PUMP, GOVERNOR, LINES, AND FILTERS Inspect mountings and for leaks and damage. Clean filters thoroughly.
9	●						GENERATOR, STARTER, AND REGULATOR Inspect for secure mountings and tight connections.
10	●						HYDRAULIC RESERVOIR AND LINES Inspect for leaks.
11						100	TANDEM DRIVE HOUSING <i>a.</i> Check oil level. Fill to bottom of filler opening. <i>b.</i> Change oil. <i>c.</i> Clean and reoil breather.
12						1000	POWER CONTROL HOUSING <i>a.</i> Check oil level. Add oil to bottom of the level plug opening. <i>b.</i> Change oil.
13						100	RADIATOR <i>a.</i> Check for leaks, and clean exterior as required. <i>b.</i> Check antifreeze protection (Ref TB 750-651). <i>c.</i> Drain and flush radiator and engine.
14	●			●			BATTERY Check specific gravity of electrolyte in each cell (Ref TM 9-6140-200-14).
15		●					EXHAUST SYSTEM Inspect for leaks or component damage.
16		●					FUEL TANK Drain and clean.
17						10	TRANSMISSION <i>a.</i> Check oil level. Level should be at the full mark on the gage (dipstick). <i>b.</i> Change filter. <i>c.</i> Change oil. <i>d.</i> Service breathers. <i>e.</i> Service screen and strainer.
18						100	AXLE HOUSING <i>a.</i> Check oil level. Add oil to maintain level to top of filler neck. <i>b.</i> Change oil.
19						1000	CLUTCH

columns are deleted.

Page 4-3. Paragraph 4-10c is superseded as follows:

c. Remove the breather lines, engine side panel, and the oil filter assembly drain plug (fig. 4-2), and allow the oil to drain.

Paragraph 4-10d. First sentence is superseded as follows:

Remove the filter housing.

Page 4-5. Paragraph 4-13a(1), second sentence is deleted.

Page 4-7. Paragraph 4-13b(4) is superseded as follows:

(4) Install the side panel.

Paragraph 4-13c, line 2, after inches add "Ref. fig. 4-7".

Paragraph 4-13c(6) is superseded as follows:

(6) Check the pedal free play and adjust as required.

(a) Remove cotter pin (6) and pin (7).

(b) Loosen jam nut on clutch rod (3).

(c) Lengthen rod (3) to increase free play, shorten to decrease.

(d) Tighten jam nut and reassemble in reverse order.

(e) Check for correct pedal (11) free travel 1-7/8 to 2 inches.

Figure 4-8 is superseded as follows:

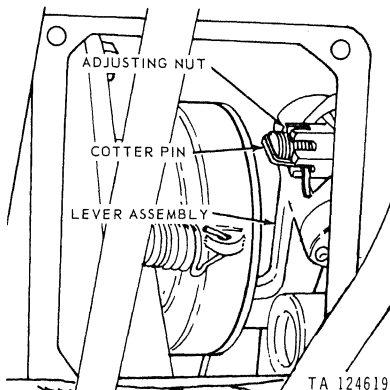


Figure 4-8. Flywheel clutch adjustment.

Page 4-8. Paragraph 4-15a(1), add new sentence before Disconnect.

Close the fuel shut-off valve (fig. 4-12) located under the fuel tank, on the right side of the vehicle.

Page 4-10. Paragraph 4-17a(9)(b) is superseded as

(9) Remove the fan guard and attach a suitable hoist to support the radiator.

Paragraph 4-27 is superseded as follows:

4-27. Water Pump

a. Removal

(1) Drain cooling system.

(2) Remove side panels.

(3) Remove fan guard.

(4) Remove water inlet and outlet hoses (fig. 4-29.) and remove by-pass tube between pump and thermostat housings.

(5) Remove mounting bolts and water pump.

b. Installation

(1) Install new gaskets.

(2) Install water pump by reversing the removal procedure.

(3) Service the cooling system. Start the engine and check for leaks.

(4) Shut down the engine and install the fan guard and side panel.

Figure 4-20 is superseded as follows:

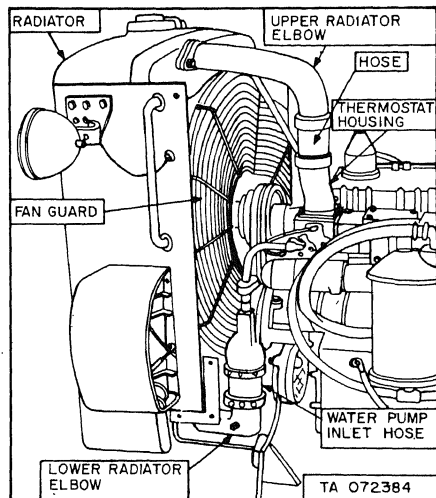


Figure 4-20. Radiator.

Paragraph 4-28 is superseded as follows:

4-28. Fan

a. Removal

(1) Remove hood (para 4-56).

(2) Loosen alternator adjusting belt to loosen

- (1) Install fan bracket, shaft, and pulley.
- (2) Install fan blades.
- (3) Adjust fan belts (para 4-29b).
- (4) Install fan guard.
- (5) Install hood.

Page 4-16. Paragraph 4-33a(2) is superseded as follows:

(2) Remove left side panel, tag and disconnect output and ground wires.

Paragraph 4-33a, add the following:

NOTE

When testing the electrical system, a multimeter, TS 352 B/U or AN/URN 105, may be used. Instructions in the use of the multimeter will be found in TM 11-6625-203-12 and TM 11-6625-366-15; or in PS magazine, issue 248, dated July 1973.

Paragraph 4-33. Subparagraphs "a" and "b" are reversed in order to test alternator before removal.

Page 4-18. Paragraph 4-35a(1) is superseded as follows:

(1) Remove the seat and open the battery box access cover.

Paragraph 4-38, before item (1) add the following note:

NOTE

Change oil and filter, and clean strainer after the first 250 hours of operation of a new or reconditioned transmission.

Paragraph 4-38a, line 2, add "(Ref. para 3-16)".

Page 4-19. Paragraph 4-38b(1) is superseded as follows:

(1) Remove the seat and lift the oil filter access cover.

Figure 4-32. Leader for callout 3 should point to cover with six holes. Leader for callout 5 should point to plate (Presently callout 3).

Page 4-20. Legend for figure 4-36 delete "item 12".

Page 4-21. Paragraph 4-39a(9), line 1 delete "12" from sentence.

Page 4-26. Following paragraph 4-49b add the following:

c. *Linkage adjustment* (Refer to fig. 4-44).

- (1) Loosen the linkage clevis locknut.
- (2) Remove the cotter pin from the clevis.
- (3) Remove the pin.
- (4) Remove the clevis from the lever. Screw the clevis onto the cable four full turns.
- (5) Install the clevis, pin, and cotter pin.

NOTE

The parking brake is properly adjusted when a reasonably hard pull is required for engagement and when the brake holds the grader.

Paragraph 4-50a is superseded as follows:

a. *Adjustment.* Refer to figure 4-45.

(1) Raise one side of the grader at a time so the wheels clear the ground, and secure.

(2) Remove the dust cover from the front of the brake backing plate (1).

(3) Insert adjusting tool (2) through the adjustment hole. Rotate the star wheel (3) with the adjusting tool by pushing down on the tool and moving the brake shoe (4) out until the lining (5) contacts the drum (6).

NOTE

Insure that the brake shoe has locked the wheel by attempting to turn the wheel in either direction. If the wheel moves, the brake shoe is not in solid contact with the drum. Wheel movement is restricted to taking up the slack in the tandem drive chain.

(4) Turn the star wheel (3) back three notches for used linings or five notches for new linings.

(5) Install the front dust cover and remove the dust cover from the rear of the backing plate.

(6) Insert the adjusting tool (2) through the adjustment hole. Rotate the star wheel (3) with the adjusting tool by pushing up on the tool and moving the brake shoe (4) out until the lining (5) contacts the drum (6).

(7) Insure that the brake shoe has locked the wheel; then turn the star wheel back three notches for used linings, or five notches for new linings.

(8) Install the rear dust cover.

(9) Repeat the adjustment for the remaining wheels.

(10) Test the brakes. Check the hydraulic brake fluid level and add as necessary (para 3-21).

Page 4-28. Following paragraph 4-54b(1) add the following:

NOTE

Repairs may be accomplished without removing tire from the grader.

Page 4-29. Paragraph 4-54b(2) is superseded as follows:

(2) Check usable tread remaining on tire.

Paragraph 4-54b(3) is superseded as follows:

(3) Replace defective valve cores.

CAUTION

Note the direction of rotation of tire to be mounted, and mount for proper directional pull.

Paragraph 4-54c, change third sentence to read: Inflate to 35 psi front, 28-30 psi rear, with tires cold.

Following paragraph 4-58 add the following:

4-58.1. Seat

a. *Removal.* Remove two hinge pins and remove the seat from the grader. Refer to figure 4-50.1.

b. *Repair.* Repair torn cover on the cushion or backrest with a cloth mending tape. Inspect the seat riser for dents and bends, and straighten as required. Straighten the seat adjustment paths if they are bent.

Figure 4-50.1 is superseded as follows:

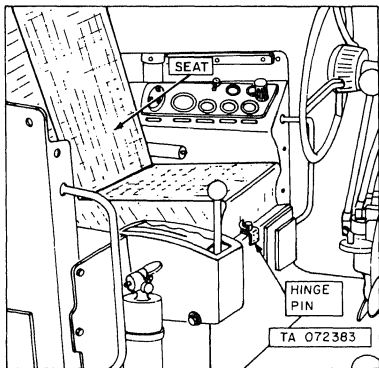


Figure 4-50.1 Seat assembly.

Paragraph 4-60a is superseded as follows:

a. Park the grader and lower the blade. Remove the hydraulic filler cap.

Page 4-30. Paragraph 4-60d delete the first sentence.

Paragraph 4-60i is superseded as follows:

i. Install the filler cap finger tight. Start the engine. Raise the blade.

Paragraph 4-60k is superseded as follows:

k. Open the hydraulic cylinder vent valves. Operate the blade sideshift until air-free oil flows out of the vent valves. Close the vent valves.

Paragraph 4-60m is superseded as follows:

Paragraph 4-61b(1) is superseded as follows:

(1) Install the filter assembly in the reverse order of removal. Tighten bolts securely.

Paragraph 4-16b(3) is superseded as follows:

(3) Start the engine and operate the blade sideshift and steering through several complete cycles.

Page 4-31. Paragraph 4-62b(2) is superseded as follows:

(2) Start the engine and operate the blade sideshift and steering through several complete cycles to expel all air from the system.

Page 4-32. Paragraph 4-64b(3) is superseded as follows:

(3) Start the engine and operate the blade sideshift and steering through several complete cycles. Turn the steering wheel from the extreme left to the extreme right.

Paragraph 4-65b(3) is superseded as follows:

(3) Start the engine and operate the blade sideshift and steering wheel through several complete cycles.

Page 4-33. Following paragraph 4-66 add the following:

4-66.1 Steering gear.

a. *Removal* (fig. 4-57.1).

(1) Position the front wheels straight ahead.

(2) Disconnect hydraulic lines at the steering control valve. Cap or plug openings.

(3) Remove the key, nut, and lockwasher connecting the shaft to the control valve.

(4) Remove the bolts and nuts, and remove the steering gear from the front of the grader.

b. *Installation.*

(1) Install the steering gear in the reverse order of removal.

(2) Service the housing with lubricant. Refer to paragraph 3-18.

(3) Check the steering shaft for binding caused by misalignment. Adjust the alignment using set screws in the bracket (fig. 4-57.1).

(4) Adjust the steering gear backlash as instructed in c below.

(5) Adjust the control valve as instructed in d below.

c. *Backlash Adjustment.*

(1) Raise the front of the grader until the tires clear the ground.

(2) Center the steering gear by turning the steering wheel from the extreme right to the

Center the wheel straight ahead and insure that the steering wheel is free to rotate.

(2) Remove covers at both ends of housing.

(3) Prevent the spool from turning by inserting a screwdriver into the slotted end of the spool. Loosen the locking bolt.

(4) Rotate the spool as required until the slotted end is flush with the face of the housing.

(5) Install covers on both ends of housing.

Add figure 4-57.1.

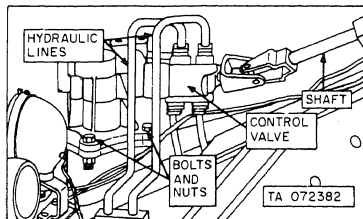


Figure 4-57.1 Steering gear assembly.

Page 4-37. Figure 4-65. Change "PINION" to read "RACK". Add leader and callout for pinion. Refer to figure 4-63 for proper callout placement.

Page 4-39. Paragraph 4-73c(3) is superseded as follows:

(3) Pack the bearing with proper lubricant.

Page 4-42. Paragraph 4-79, before subparagraph a add the following:

CAUTION

Do not allow cutting edges and end bits to wear closer than approximately 3/4 inch of the moldboard.

Page 5-1. Section II change "TM 750-244-13" to read "TM 750-244-3".

Page B-3.

Group 0106, line 5.

Column H change "F" to read "0".

Column I add "F".

Group 0200, line 2, columns H and I add "F".

Group 0302, lines 2 and 3, columns B and H change "0" to read "F".

Group 0305. Delete entire line.

Page B-4. Group 0600, line 3, remarks column delete "C-1".

Page B-5. Group 1201. Delete entire group.

Page B-6. Group 1401, column H, line 3 change "F" to read "0".

Group 1501, line 2, column A change "0" to read "C".

Page B-8. Section IV, delete line C-1 in its entirety.

Page C-1. Appendix C is superseded as follows.

APPENDIX C

BASIC ISSUE ITEMS LIST AND ITEMS TROOP INSTALLED OR AUTHORIZED

Section I. INTRODUCTION

C-1. Scope

This appendix lists basic issue items, items troop installed or authorized which accompany the road grader and are required by the crew/operator for operation, installation, or operator's maintenance.

C-2. General

This basic issue items, items troop installed or authorized list is divided into the following sections:

a. *Basic Issue Items List—Section II.* Not applicable.

b. *Items Troop Installed or Authorized List—Section III.* A list in alphabetical sequence of items which at the discretion of the unit commander may accompany the end item, but are NOT subject to be turned in with the end item.

C-3. Explanation of Columns

II, and Items Troop Installed or Authorized, Section III.

a. *Source, Maintenance, and Recoverability Code(s) (SMR):* Not applicable.

b. *Federal Stock Number.* This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. *Description.* This column indicates the Federal item name and any additional description of the item required.

d. *Unit of Measure (U/M).* A 2-character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowances are based, e.g., ft, ea, pr, etc.

e. *Quantity Authorized (Items Troop Installed or*

(1) SMR Code	(2) NATIONAL Stock number	(3) Description	(4) Unit of Issue	(5) Qty Inc in unit	(6) Qty furn with equip	(7) ILLUSTRATION	
						(a) fig no.	(b) item no.
PC	3805-00-423-9746	Tooth, tooth extractor	EA		1	1	
PC	5120-00-223-7397	Pliers, slip joint, 8 inch	EA		1	1	
PC	5120-00-224-4057	Hammer, hand, machinist, 2 lb	EA		1	1	
PC	5120-00-264-3796	Wrench, open end, adjustable, 12 inch	EA		1	1	

THIS PAGE INTENTIONALLY LEFT BLANK.

OPERATOR AND ORGANIZATIONAL MAINTENANCE MANUAL

GRADER, ROAD, MOTORIZED, DED, TYPE I, 6 WHEEL,
4 WHEEL DRIVE, FRONT WHEEL STEERING 12 FT BLADE
(CATERPILLAR MDL 120)

FSN 3805-466-0084

		Paragraph	Page
	LIST OF ILLUSTRATIONS		
CHAPTER	INTRODUCTION		
Section	I. General	1-1	1-1
	II. Description and data	1-5	1-1
CHAPTER	2. OPERATING INSTRUCTIONS		
Section	I. Service upon receipt of material	2-1	2-1
	II. Movement to a new worksite	2-4	2-3
	III. Controls and instruments	2-8	2-4
	IV. Operation under usual conditions	2-10	2-9
	V. Operation under unusual conditions	2-14	2-17
	VI. Operation of material used in conjunction with the equipment	2-20	2-18
CHAPTER	3. OPERATOR'S MAINTENANCE INSTRUCTIONS		
Section	I. Basic issue items	3-1	3-1
	II. Lubrication instructions	3-2	3-1
	III. Preventive maintenance checks and services	3-4	3-1
	IV. Troubleshooting	3-6	3-2
	V. Maintenance of the engine	3-7	3-2
	VI. Maintenance of the fuel system	3-10	3-3
	VII. Maintenance of the cooling system	3-12	3-6
	VIII. Maintenance of the electrical system	3-14	3-6
	IX. Maintenance of drive components	3-15	3-6
	X. Maintenance of hydraulic components	3-23	3-9
	XI. Maintenance of earthmoving equipment	3-24	3-10
CHAPTER	4. ORGANIZATIONAL MAINTENANCE INSTRUCTIONS		
Section	I. Service upon receipt of materiel	4-1	4-1
	II. Movement to a new worksite	4-2	4-1
	III. Special tools and equipment	4-3	4-1
	IV. Preventive maintenance checks and service	4-5	4-1
	V. Troubleshooting	4-7	4-1
	VI. Radio interference suppression	4-8	4-1
	VII. Maintenance of the engine	4-10	4-3
	VIII. Maintenance of the clutch	4-13	4-5
	IX. Maintenance of the fuel system	4-14	4-7
	X. Maintenance of the air induction and exhaust system	4-20	4-11
	XI. Maintenance of the cooling system	4-24	4-13
	XII. Maintenance of the electrical system	4-32	4-16
	XIII. Maintenance of transmission and drive components	4-38	4-18
	XIV. Maintenance of the front axle	4-42	4-21
	XV. Maintenance of the brakes	4-48	4-24
	XVI. Maintenance of the wheels	4-53	4-27
	XVII. Maintenance of the frame and body	4-55	4-29

CHAPTER	5. ADMINISTRATIVE STORAGE AND INSTRUCTIONS FOR DESTRUCTION OF MATERIEL TO PREVENT ENEMY USE	
Section	I. Administrative storage	5-1
	II. Destruction of materiel to prevent enemy use	5-1
APPENDIX	A. REFERENCES	A-1
	B. MAINTENANCE ALLOCATION CHART	B-1
	C. BASIC ISSUE ITEMS LIST	C-1
INDEX		I-1

Number	Title	Page
1-1	Grader, left front, three quarter view	1-2
1-2	Grader, right rear, three quarter view	1-2
1-3	Wiring diagram	1-5
1-4	Hydraulic schematic diagram	1-6
2-1	Tie bar lock bolt	2-1
2-2	Lift linkage adjustment	2-2
2-3	Blade tilt adjustment	2-2
2-4	Centershift link adjustment	2-2
2-5	Repositioning centershift link	2-2
2-6	Moldboard adjustment	2-3
2-7	Scarifier adjustment	2-3
2-8	Transportation data plate	2-4
2-9	Instrument panel	2-5
2-10	Master light switch	2-6
2-11	Operator's compartment arrangement	2-7
2-12	Blade control levers	2-8
2-13	Service meter and air cleaner indicator	2-8
2-14	Turning grader to right moving forward	2-10
2-15	Turning grader to left, moving backward	2-11
2-16	Sideshift rack set for right hand leveling	2-11
2-17	Centershift rack set for left hand leveling	2-12
2-18	Sideshift rack set for right hand shoulder cleanup	2-12
2-19	Roadbuilding - "V" ditch method	2-14
2-20	Roadbuilding - flat bottom ditch method	2-16
3-1	Engine oil service	3-2
3-2	Crankcase breather	3-3
3-3	Priming fuel system	3-4
3-4	Air cleaner service	3-5
3-5	Transmission service	3-7
3-6	Axle housing	3-7
3-7	Axle breather	3-7
3-8	Steering gear service	3-7
3-9	Tandem drive housing dipstick	3-8
3-10	Parking brake lever	3-8
3-11	Parking linkage adjustment	3-9
3-12	Brake master cylinder filler	3-9
3-13	Hydraulic filler cap	3-9
3-14	Power control housing service	3-10
3-15	Power control worm and gear housing filler plug	3-10
3-16	Circle transfer gear housing filler plug	3-10
3-17	Circle reverse control housing filler plug	3-10
3-18	Centershift control housing service	3-11
3-19	Blade lift control housings service	3-11
3-20	Scarifier control upper housing	3-11
3-21	Scarifier control lower housing	3-11
4-1	Crankcase drain plug	4-3
4-2	Oil filter assembly	4-3
4-3	Flywheel housing timing plug	4-4
4-4	Rocker arm cover bolts torque sequence	4-4
4-5	Valve lash adjustment	4-4
4-6	Crankcase breather	4-5
4-7	Clutch pedal and linkage	4-6
4-8	Flywheel clutch adjustment	4-7
4-9	Fuel system schematic diagram	4-8
4-10	Fuel transfer pump	4-9
4-11	Fuel primer pump	4-9
4-12	Fuel shutoff valve	4-10
4-13	Primary fuel filter	4-10
4-14	Secondary fuel filter	4-10
4-15	Fuel tank	4-11
4-16	Air cleaner	4-12
4-17	Exhaust manifold	4-12
4-18	Exhaust pipe and muffler	4-13
4-19	Cooling system schematic diagram	4-13

Number	Title	Page
4-20	Radiator	4-14
4-21	Water pump	4-14
4-22	Fan belts	4-15
4-23	Water thermostat removal	4-15
4-24	Oil cooler	4-16
4-25	Alternator	4-16
4-26	Continuous circuit test setup	4-16
4-27	Ground test setup	4-17
4-28	Field current draw test setup	4-17
4-29	Starting motor	4-17
4-30	Starting motor test setup	4-17
4-31	Transmission drain plugs	4-18
4-32	Transmission screen and strainer	4-19
4-33	Transmission oil filter	4-19
4-34	Transmission housing breather	4-20
4-35	Transmission filler breather	4-20
4-36	Shift control linkage	4-20
4-37	Axle housing	4-21
4-38	Tandem drive housing drain plug	4-21
4-39	Steering knuckle and leaning wheel arm	4-22
4-40	Leaning wheel tie bar	4-23
4-41	Tie rod	4-23
4-42	Steering arm	4-23
4-43	Lean control housing filler plug	4-24
4-44	Parking brake linkage and lever	4-25
4-45	Service brakes adjustment	4-26
4-46	Bleeding brakes	4-26
4-47	Brake master cylinder	4-27
4-48	Brake pedal and linkage	4-27
4-49	Centering steering gear	4-28
4-50	Front wheel alignment	4-28
4-51	Hydraulic tank drain cover	4-30
4-52	Hydraulic oil filter	4-30
4-53	Hydraulic junction	4-31
4-54	Blade shideshift control valve	4-31
4-55	Relief valve	4-32
4-56	Hydraulic pump	4-32
4-57	Hydraulic oil tank	4-33
4-58	Lift arm and link	4-34
4-59	Lift shaft adjustment	4-34
4-60	Blade lift control brake	4-35
4-61	Worm gear adjustment	4-35
4-62	Blade lift control housing	4-35
4-63	Centershift rack	4-36
4-64	Circle centershift control housing	4-36
4-65	Checking pinion backlash	4-37
4-66	Circle guide shoes	4-37
4-67	Circle reverse gear housing	4-37
4-68	Transfer gear housing	4-38
4-69	Bevel pinion case	4-38
4-70	Drive shaft and universal joints removal	4-39
4-71	Universal joint disassembly	4-39
4-72	Power control drive shaft	4-39
4-73	Power control drive shaft, exploded view	4-40
4-74	Ball and socket joint	4-40
4-75	Power control housing	4-41
4-76	Power control worm and gear housing drain plug	4-41
4-77	Circle adjustment	4-41
4-78	Drawbar ball and socket joint	4-42
4-79	Blade assembly	4-42
4-80	Scarifier control housing	4-43
4-81	Scarifier assembly	4-43
4-82	Scarifier control upper housing	4-44

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope

These instructions are published for the use of personnel who are issued the Model 120 Motorized Road Grader. This manual contains instructions for Operator and Organizational levels of maintenance for the equipment and its accessories and includes descriptions of main units and their functions.

1-2. Forms and Records

For appropriate forms and records and their applications to the Model 120 Motorized Road Grader, refer to TM 38-750.

1-3. Equipment Serviceability Criteria

Refer to TM 5-3805-201-ESC.

1-4. Reporting of Errors

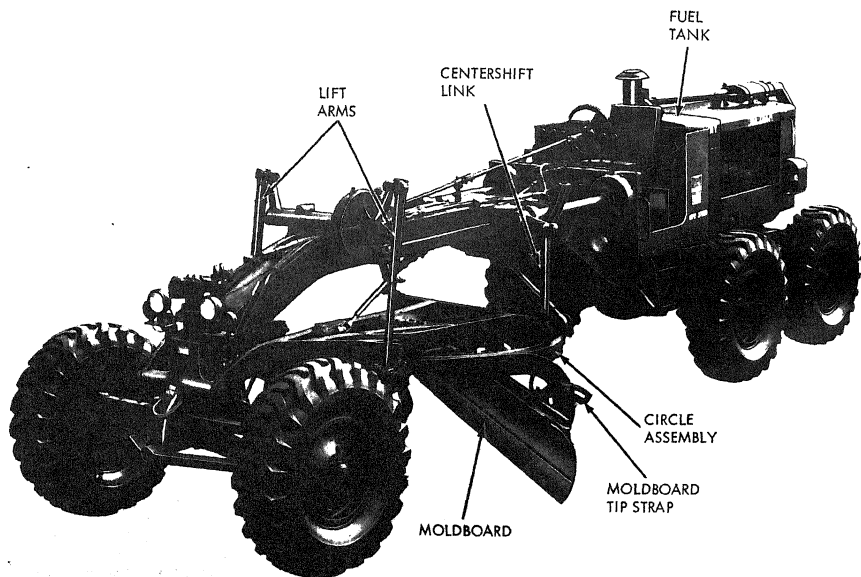
Report of errors, omissions, and recommendations for improving this publication is encouraged. Reports should be submitted on DA Form 2028, Recommended Changes to Publications, and forwarded to U. S. Army Mobility Command, 4300 Goodfellow Blvd., St. Louis, Mo. 63120.

Section II. DESCRIPTION AND DATA

1-5. Description.

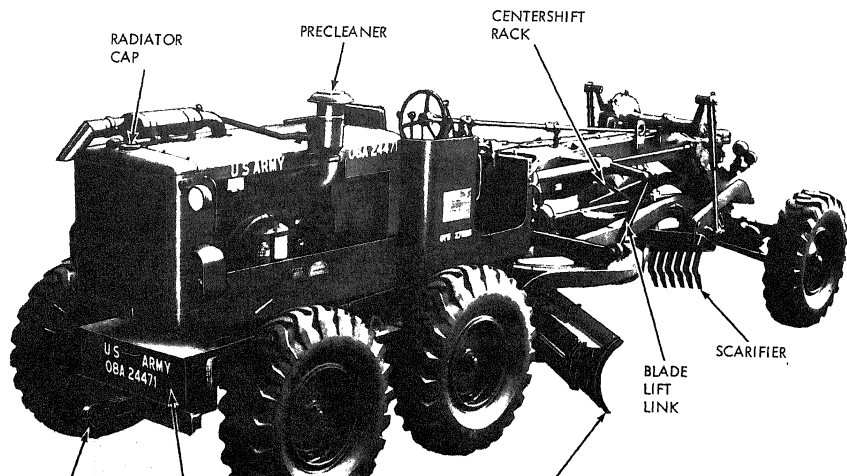
a. *General.* The Model 120 Motorized Road Grader (fig. 1-1 and 1-2), built by the Caterpillar Tractor Co, is equipped with powershift trans-

mission, hydraulic steering, four driving wheels, and two steerable leaning front wheels. It also incorporates a scarifier assembly and a twelve-foot hydraulically-controlled sideshift blade.



ME 3805-249-12/1-1

Figure 1-1. Grader, left front, three quarter view.



c. Transmission and Drive Lines.

(1) *Transmission.* The power shift transmission provides six forward and six reverse speeds. Range selection is controlled by a single lever.

(2) *Rear axle.* The grader is driven by a tandem drive unit which transmits power from the transmission to the wheels by means of drive chains.

d. *Steering.* Front axle steering is controlled by a hydraulic pump and mechanical linkage. The steerable wheels are equipped with lean control to aid in operating.

e. *Earthmoving Equipment.* The grader is equipped with a 12 foot hydraulic sideshift blade and a scarifier.

1-6. Differences between Models

This manual covers only the Model 120 Road Grader. No known unit differences exist for the model.

1-7. Identification and Tabulated Data

a. *Identification.* The Model 120 Motorized Road Grader has nine major identification plates.

(1) The Army data plate, located on the left exterior of the operator's compartment, gives the model, contract, registration and serial numbers as well as dimensions and shipping weight.

(2) The lubrication instructions plate, located on the right exterior of the operator's compartment, gives maintenance lubrication intervals, quantities and lubricants.

(3) A warning plate, located on the right interior of the operator's compartment, provides precautionary information concerning starting and parking.

(4) A safety plate, located on the right interior of the operator's compartment, gives precautions to be observed while the grader is in motion.

(5) The air cleaner instructions plate, located on the right side panel of the engine compartment, gives air cleaner service instructions.

(6) The shifting instruction plate is located on the right side of the operator's compartment and provides shifting instructions and warnings.

(7) The transmission filter instruction plate is mounted on top of the transmission filter access cover and provides service information.

(8) The fuel filter instruction plate, located on the right side panel of the engine compartment, provides filter service instructions.

(9) The direct electric starting instructions plate is located on the right side of the operator's

Manufacturer	Caterpillar Tractor Co
Model	120
Serial number range	90R1 and subsequent

(2) Engine.

Make	Caterpillar Tractor Co
Model	D 333
Cycles	4
Number of cylinders	6, in line
Bore	4.75 inches
Stroke	6 inches
Injector size	9.0 millimeters
Displacement	6.38 cubic inches
Rated power	121 horsepower at 2000 rpm
Firing order	1-5-3-6-2-4
Low idle speed	650 rpm
Full load speed	2000 rpm
Lubricant capacity	7.25 gallons

(3) Air cleaner.

Make	Donaldson Co
Model	EGB 12-0076
Type	Dry air

(4) Oil filter.

Type	Pleated paper
Make	Caterpillar Tractor Co
Housing number	3R9742
Element number	MS35802-3

(5) Fuel filter.

(a) Primary.

Type	Bowl
Make	Caterpillar Tractor Co

(b) Secondary.

Type	PR 161-2
Make	Purolator Products, Inc
Element number	51368

(6) Fuel pump.

Type	In line
Make	Caterpillar Tractor Co

(7) Governor.

Type	Centrifugal, mechanical
Make	Caterpillar Tractor Co
Low idle speed	650 rpm
High idle speed	2000 rpm

(8) Starter motor.

Type	Heavy duty
Make	Delco-Remy
Capacity	24 Volts
Model	1113987

(9) Radiator.

Type	Heavy duty fin and tube
Capacity	11 gallons
Make	Caterpillar Tractor Co

(11) *Water pump.*

Type Centrifugal valve
Make Caterpillar Tractor Co
Drive Belt

(12) *Water temperature regulator.*

Type Metal expansion
Make Detroit Controls Corp
Model VD-10333
Temperature rating 165° F

(13) *Transmission.*

Type	Powershift
Make	Caterpillar Tractor Co.
Lubricant capacity	20 gallons
Speed range (at maximum throttle)	
Forward (mph)	
First	2.09
Second	3.67
Third	5.81
Fourth	7.99
Fifth	13.92
Sixth	22.25
Reverse (mph)	
First	2.51
Second	4.42
Third	6.93
Fourth	9.65
Fifth	16.70
Sixth	26.3

(14) *Wheel brakes.*

Type	Hydraulic
Make	Wagner Electric Corp
Model	FF-51100/FF-51101
Number of brake drums	4
Brake drum diameter	16.998 ± 0.003 inches
Brake lining thickness	0.050 inch
Brake shoe area	70.64 square inches

(15) *Steering gear.*

Type Hydraulic / mechanical
Make Caterpillar Tractor Co
Capacity 1 quart
Location Front frame

(16) *Hydraulic tank.*

MakeCaterpillar Tractor Co
Capacity4.5 gallons
Filler locationTank top

(17) *Hydraulic pressure relief valve.*

Type Spring-loaded
Make Caterpillar Tractor Co
Pressure setting 775 ± 25 psi

(18) *Hydraulic pump.*

Type	Vane
Make	Vickers
Model	V200-8-OD-S / 48
Drive	Splined coupling
Delivery	8.2 gpm at 1200 rpm and 0 psi

(19) *Tires.*

Type Tubeless
Make Caterpillar

Rating speed 10 mph

(20) *Battery.*

Number	2
Size	6 TN
Voltage	12
Make	Caterpillar Tractor Co
Rating	100 amp
Number of plates	138

(21) *Alternator.*

Type	Brushless, internal regulator
Volts	24
Make	Delco-Remy
Model	111 7226
Drive	Belt

(22) *Horn.*

Type	Electric
Make	Sparton Mfg Co
Model	A-25472
Cycles	270
Intensity	136 decibels at 4 inches

(23) *Engine oil pressure gage.*

Make	Stewart-Warner
Range	0 to 40 psi
Location	Instrument panel
Normal operating pressure ..	20 to 40 psi

(24) *Service meter.*

Type	Digital, mechanic
Actuated by	Transfer pump drive shaft
Make	English Numbering Machines
Location	Left side of engine
Gear ratio	54,000 revolutions / count

(25) *Water temperature indicator.*

Make	Stewart-Warner
Model	P-346-BC-183
Range	120° to 260° F
Location	Instrument panel
Normal operating temperature	160° to 227° F

(26) *Fuel pressure gage.*

Make	Stewart-Warner
Range	0 to 28 psi
Location	Instrument panel
Normal operating pressure ..	17 to 28 psi

(27) *Transmission oil pressure gage.*

Make	Rochester Mfg C
Range	0 to 450 psi
Location	Instrument panel
Normal operating pressure ..	200 to 350 psi

(28) *Ammeter.*

Make Stewart-Warner or Rochester
Mfg Co
Range -50 to +50 amps
Location Instrument panel

(29) *Speedometer.*

Make A.C. Spark Plug or Stewart-Warner
Range 0 to 80 mph
Location Instrument panel

(31) Physical and functional dimensions.

Overall length	322.0 inches
Overall height	95.0 inches
Overall width	96.0 inches
Shipping volume	1700 cubic feet
Shipping weight	27800 pounds
Shipping tonnage	43 tons
Front axle load	8200 pounds
Rear axle load	19600 pounds
Operating weight	27800 pounds
Overall blade width	12 feet
Tread width	13 inches
Width across tires	
front	80 inches
rear	79¼ inches
Scarifier	
number of teeth	11
swath width	46½ inches
scarifying depth	9 inches

(32) Torque data.**Special Torques**

<i>Fastener</i>	<i>Torque (ft lbs)</i>
Crankshaft pulley retaining bolt	200-220
Engine support bolt	130-170
Flywheel retaining bolt	130-170
Flywheel housing retaining bolt	65-85
Glow plugs	10-12
Rocker arm cover retaining bolt	6-10
Timing gear housing retaining bolt	27-37
Water pump adapter retaining nut	85-95
Transmission oil pump studs	17-23
Hydraulic pump cover bolt	65-75
Steering booster retaining screw	12-14
Steering booster cover screw	12-14
Steering booster adapter bolt	18-19
Steering arm-to-pitman shaft retaining nut	300-340
Sprocket-to-axle shaft retaining nut	400-450

Blade lift housing retaining bolt 160-200
 Bevel gear-to-worm shaft retaining nut 275-310

General Torques**Bolts and Nuts**

<i>Size (in.)</i>	<i>Torque (ft lbs)</i>	<i>Size (in.)</i>	<i>Torque (ft lbs)</i>
1 / 4	9 ± 3	3 / 4	265 ± 35
5 / 16	18 ± 5	7 / 8	420 ± 60
3 / 8	32 ± 5	1	640 ± 80
7 / 16	50 ± 10	1 1 / 8	800 ± 100
1 / 2	75 ± 10	1 1 / 4	1000 ± 120
9 / 16	110 ± 15	1 3 / 8	1200 ± 150
5 / 8	150 ± 20	1 1 / 2	1500 ± 200

Taperlock Studs

<i>Size (in.)</i>	<i>Torque (ft lbs)</i>	<i>Size (in.)</i>	<i>Torque (ft lbs)</i>
1 / 4	5 ± 2	3 / 4	110 ± 15
5 / 16	10 ± 3	7 / 8	170 ± 20
3 / 8	20 ± 3	1	260 ± 30
7 / 16	30 ± 5	1 1 / 8	320 ± 30
1 / 2	40 ± 5	1 1 / 4	400 ± 40
9 / 16	60 ± 10	1 3 / 8	480 ± 40
5 / 8	75 ± 10	1 1 / 2	550 ± 50

Hydraulic Valve Bolts and Nuts

<i>Size (in.)</i>	<i>Torque (ft lbs)</i>	<i>Size (in.)</i>	<i>Torque (ft lbs)</i>
5 / 16	15 ± 2	1 / 2	65 ± 5
3 / 8	27 ± 3	5 / 8	130 ± 12
7 / 16	43 ± 4		

Note. These values apply to fasteners dry, or when lubricated with engine oil. They do not apply if special graphited or molybdenum disulfide greases or other extreme pressure lubricants are used.

(33) *Wiring diagram.* Refer to figure 1-3.

*Figure 1-3. Wiring diagram
(Located in back of manual)*

(34) *Hydraulic schematic diagram.* Refer to figure 1-4.

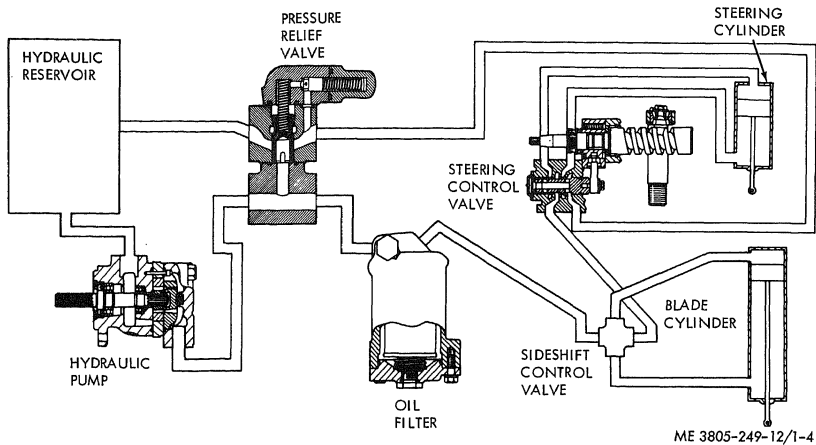


Figure 1-4. Hydraulic schematic diagram.

Section I. SERVICE UPON RECEIPT OF MATERIEL

2-1. Inspecting and Servicing the Equipment

Caution: Before unloading the grader, check tire pressure and inflate as necessary to 35 psi.

a. Inspect the identification plates and receipt invoices to ensure receipt of proper equipment.

b. Inspect the body, frame, and all external parts for damage or loss which may have occurred during shipping.

c. Inspect hydraulic, oil and fuel lines for leaks or loose fittings.

d. Inspect electrical wiring for frayed insulation and broken connections.

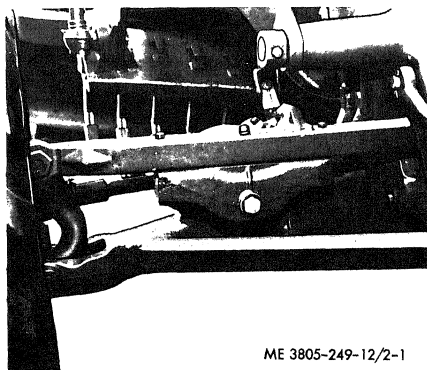
e. Check and tighten as necessary all accessible nuts, bolts and other attaching hardware. Refer to paragraph 1-7 for torque data.

f. Inspect the engine cooling system for leaks and proper coolant mixture. Correct coolant level is within one inch of the top of the radiator. Refer to TB 750-651 for cooling system maintenance instructions.

g. Perform the daily maintenance checks and services described in paragraph 3-5.

2-2. Installation

a. Before operating the front wheel lean control lever, remove the bolt which locks the tie bar to the front axle shaft. Refer to figure 2-1.



ME 3805-249-12/2-1

Figure 2-1. Tie bar lock bolt.

b. Install the knobs on the blade and scarifier control levers (fig. 2-12). The knobs will be found in the tool box (fig. 1-2).

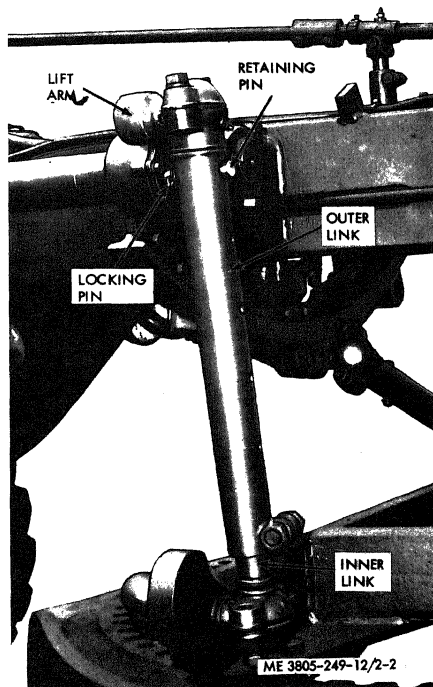
c. Place the fire extinguisher in its bracket on the right side of the cab interior.

2-3. Equipment Conversion

a. *General.* This paragraph describes adjustment operations for adapting the equipment to the various operations for which it was designed.

b. *Setting Blade Linkage.*

(1) Lower the blade to the ground to relieve weight on the links (fig. 2-2).



ME 3805-249-12/2-2

Figure 2-2. Lift linkage adjustment.

pin. Raise or lower the lift arm to set the link at the desired height. Align the pin holes in the link halves and secure with retaining pin and lock pin.

c. Setting Blade Tilt.

(1) For normal operation, set the blade in a vertical position.

(2) To tilt the blade forward or back, lower the blade to the ground, loosen the nut and lockplate (fig. 2-3), and move the grader forward or backward to tilt the blade in the desired direction.

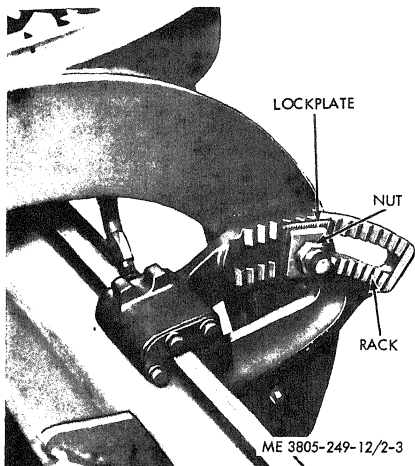


Figure 2-3. Blade tilt adjustment.

(3) Secure the nut and lockplate.

d. Adjusting Centershift Link.

(1) Lower the blade to the ground and shift the rack as necessary to remove the weight from the centershift link (fig. 2-4).

(2) Remove the snap ring from the link retaining pin and remove the retaining pin.

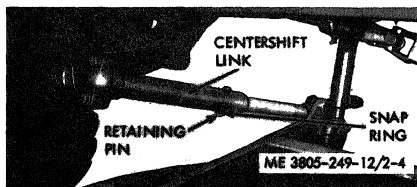


Figure 2-4. Centershift link adjustment.

(3) Shift the rack until the link is set at the desired length. Align the pin holes in the link halves and install the retaining pin and snap ring.

e. Repositioning Centershift Link.

(1) Lower the blade to the ground and shift the rack as necessary to relieve the weight on the centershift link (fig. 2-5).

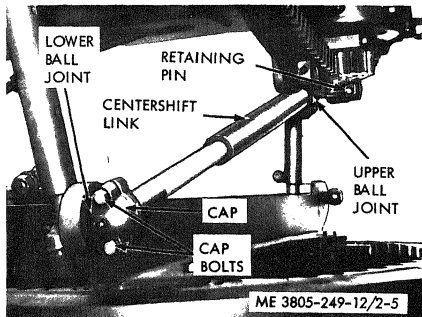


Figure 2-5. Repositioning centershift link.

(2) Loosen the lower ball joint cap bolts. Remove the cap nuts and bolts. Remove the cap and shims. Keep the shims with the cap.

(3) Remove the cotter key from the upper ball joint retaining pin, and remove the retaining pin.

(4) Remove the link and ball joint as an assembly. If necessary, use a soft head hammer to loosen the joint.

(5) Select a hole at the desired position and install the ball joint. Ensure that the taper and hole are clean.

(6) Install the upper ball joint retaining pin and cotter key.

(7) Install the lower ball joint cap and shims. Secure with cap bolts, lockwashers and nuts. Check that the joint fits snugly but works freely. If necessary, add or remove shims to tighten or loosen joint.

(8) Secure the link at the required length with retaining pin (subpara d). Lubricate the joints.

f. Extending the Moldboard.

(1) Lower the blade to the ground.

(2) Remove bolts and lockwashers securing the cylinder rod end bracket to the moldboard. Refer to figure 2-6.

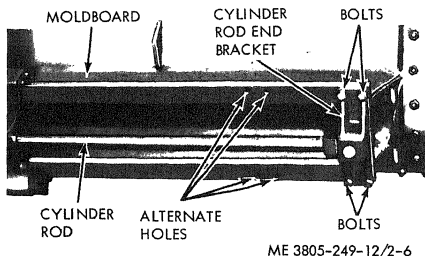


Figure 2-6. Moldboard adjustment.

(3) Retract the cylinder rod to align bolt holes in the bracket with alternate holes in the moldboard.

(4) Install the bolts and lockwashers and tighten securely.

g. Scarifier Adjustment.

(1) Lower the scarifier to the ground.

(2) Remove the bracket bolts (fig 2-7).

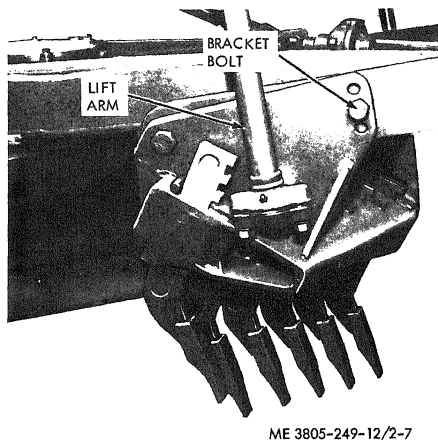


Figure 2-7. Scarifier adjustment.

(3) Raise or lower the lift link to set the angle of the scarifier. Install bracket bolts and tighten securely.

Section II. MOVEMENT TO A NEW WORKSITE

2-4. General

The grader does not require dismantling before moving to a new worksite. It may be transported by driving, towing or shipping.

2-5. Driving

Movement of the grader to a new worksite can be accomplished by moving the grader over the road under its own power. Ensure that the vehicle is properly serviced and in good operating condition. Be sure to provide clearance for other traffic when traveling on public roads.

2-6. Towing

a. When towing the grader for distances greater than ½ mile, direct or general support personnel

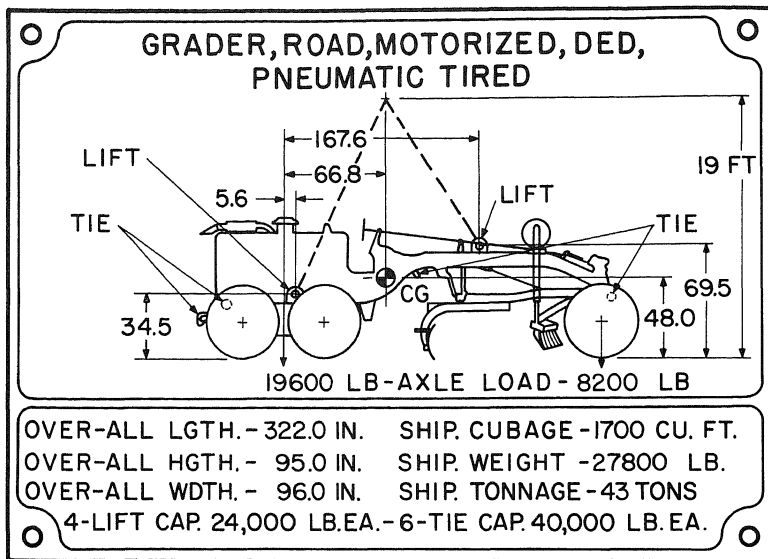
must remove the tandem drive chains. Attach a tow line to the hook at the front of the vehicle.

b. When towing the grader for distances less than ½ mile, it is not necessary to remove the tandem drive chains if the grader is transported at speeds below 5 mph.

2-7. Shipping

Long distance movement of the grader should be accomplished with suitable transportation equipment such as a flat bed truck trailer, railroad car, or carrier. Tie down and block the grader securely as instructed in the Transportation Data Plate (fig. 2-8). Perform the following operations.

a. Shift the transmission control to neutral and apply the parking brake.



ME 3805-249-12/2-8

Figure 2-8. Transportation data plate.

- b. Install the tie bar lock bolt (fig. 2-1).
- c. Install protective covers on the air cleaner intake, fuel filler cap, breathers, alternator, hydraulic filler caps, and hydraulic cylinder rods.
- d. Place a tag on the steering wheel indicating

that the above services have been performed and instructing the operator to remove the protective covers and tie bar lock bolt before operating the grader after shipment.

Section III. CONTROLS AND INSTRUMENTS

2-8. General

This section describes, locates, and illustrates the various controls and instruments and provides information about the controls to permit proper operation of the grader.

2-9. Controls and Instruments

a. *Instrument Panel.* Refer to figure 2-9.

- (1) Master light switch (1). Refer to subparagraph *b* for details and operations.
- (2) Front flood lights switch (2). A toggle switch that actuates the front flood lights.

(3) Rear flood lights switch (3). A toggle switch that actuates the rear flood lights.

(4) Heat / start switch (4). A rotary switch which actuates the starting circuit. In cold weather, momentarily place the switch in HEAT to allow the glow plugs to warm up before placing the switch in START.

(5) Water temperature indicator (5). A gage which indicates the engine coolant temperature. Normal reading is in the green zone (160° to 227°F).

Normal operating pressure is in the green zone (20 to 40 psi).

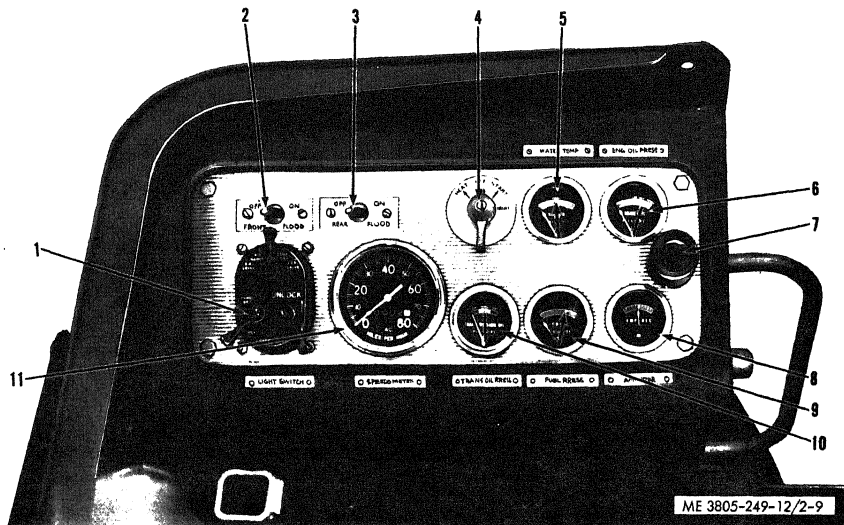
(7) Panel lamp assembly (7). A 24-volt lamp which illuminates the instrument panel.

(8) Ammeter (8). A meter which indicates the condition of the batteries and the drain on the electrical system.

(9) Fuel pressure gage (9). A gage which indicates pressure in the fuel system. Normal

psi). (10) Transmission oil pressure gage (10). A gage which indicates transmission lubricating oil pressure. Normal operating pressure is in the green zone (200 to 350 psi).

(11) Speedometer (11). A gage which monitors vehicle speed. The speedometer incorporates an odometer to record total vehicle mileage.



1. Master light switch
2. Front lights switch
3. Rear flood lights switch
4. Heat / start switch
5. Water temperature indicator
6. Engine oil pressure gage

7. Panel lamp assembly
8. Ammeter
9. Fuel pressure gage
10. Transmission oil pressure gage
11. Speedometer

Figure 2-9. Instrument panel.

b. Master Light Switch. Refer to figure 2-10.

(1) Place the selector switch in BO DRIVE to operate blackout head and taillights for blackout driving.

(2) Place the selector switch in BO MARKER for parking lights operation in blackout conditions.

(3) Place the selector switch in STOP LIGHT to operate vehicle signal lights and parking lights.

(4) Place the selector switch in SER DRIVE

to operate vehicle head and taillights, signal lights and flood lights.

Note. To place the selector switch in SER DRIVE, lift and rotate the unlock switch to the unlock position.

(5) Place the selector switch in OFF to deactivate all vehicle lights.

(6) Place the lower lever in PANEL BRT, DIM or PARK to operate the panel light or parking lights.

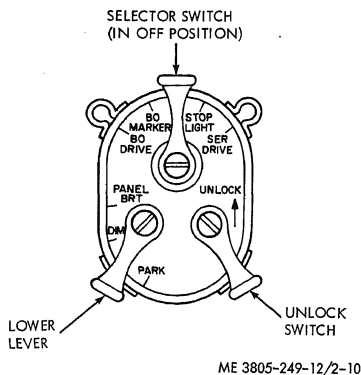


Figure 2-10. Master light switch.

c. *Operator's Compartment Arrangement.* Refer to figure 2-11.

(1) Instrument panel (1). Refer to subparagraph a for description and operation.

(2) Horn button (2).

(3) Clutch pedal (3).

(4) Steering wheel (4).

(5) Blade control levers (5). Refer to subparagraph d for description and operation.

(6) Governor control lever (6). Set the lever to maintain constant engine speed.

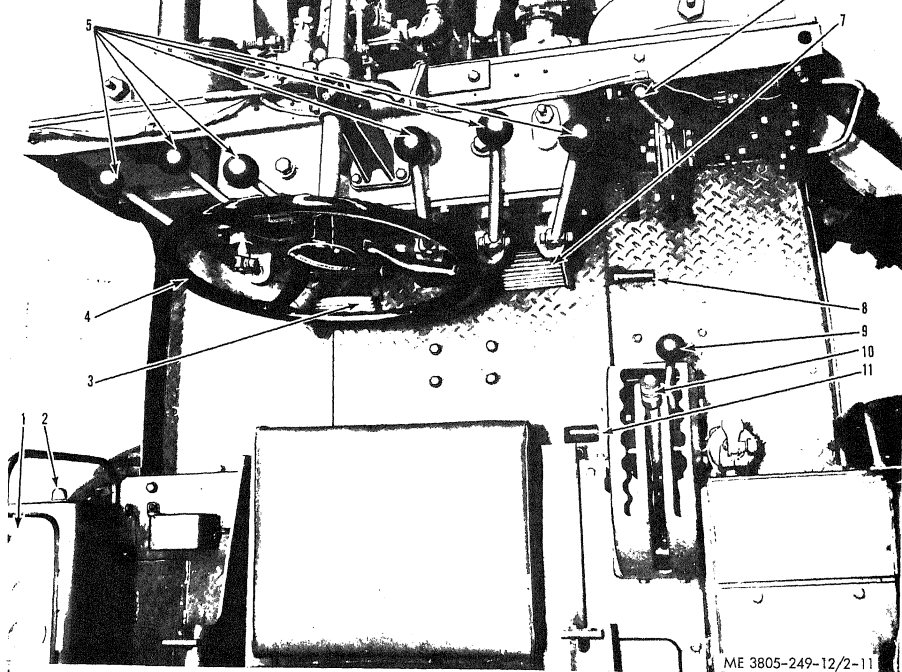
(7) Brake pedal (7).

(8) Accelerator (8).

(9) Transmission shift lever (9).

(10) Parking brake lever (10).

(11) Decelerator (11). Depress the pedal to momentarily decrease engine speed.



ME 3805-249-12/2-11

1. Instrument panel
2. Horn button
3. Clutch pedal
4. Steering wheel
5. Blade control levers
6. Governor control lever

7. Brake pedal
8. Accelerator
9. Transmission shift lever
10. Parking brake lever
11. Decelerator

Figure 2-11. Operator's compartment arrangement.

d. Blade Control Levers. Refer to figure 2-12.

(1) **Left blade lift lever (1).** Push the lever forward to lower the left side of the blade. Pull the lever back to raise the left side of the blade.

(2) **Scarifier lever (2).** Push the lever forward to lower the scarifier to the ground. Pull the lever back to raise the scarifier.

(3) **Circle reverse lever (3).** Push the lever forward to turn the circle and blade counterclockwise. Pull the lever back to turn the circle and blade clockwise.

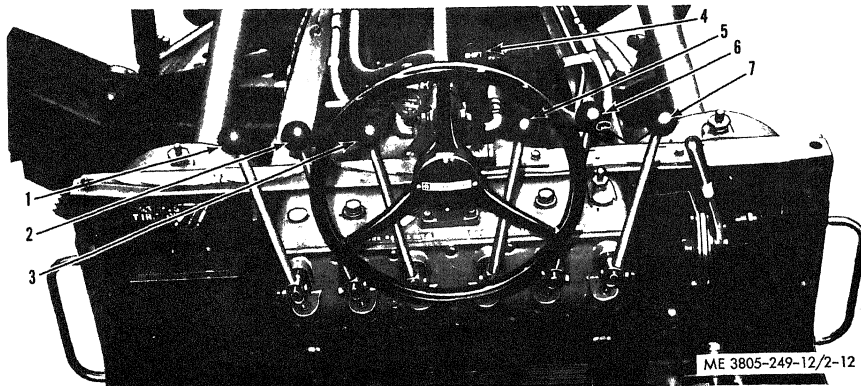
Caution: When positioning the circle, do not permit the circle to contact the centershift rack.

(4) **Shift lever (4).** Pull the lever to the right to extend the blade hydraulic cylinder. Pull the lever to the left to retract the blade hydraulic cylinder.

(5) **Sideshift lever (5).** Pull the lever back to move the centershift rack to the right. At least two teeth must remain visible at the left of the pinion. Push the lever forward to move the centershift rack to the left. At least two teeth must remain visible at the right of the pinion.

(6) **Leaning wheel lever (6).** Pull the lever back to lean the wheels to the right. Push the lever forward to lean the wheels to the left.

(7) **Right blade lift lever (7).** Pull the lever back to raise the right side of the blade. Push the lever forward to lower the right side of the blade.



1. Left blade lift lever
2. Scarifier lever
3. Circle reverse lever
4. Shift lever

5. Sideshift lever
6. Leaning wheel lever
7. Right blade lift lever

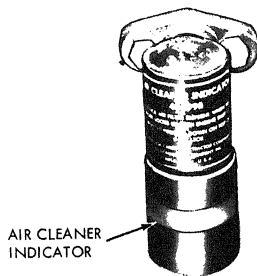
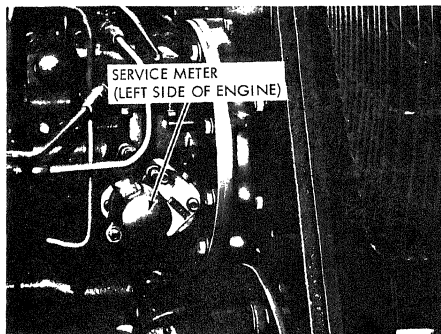
Figure 2-12. Blade control levers.

e. *Miscellaneous Instruments.* Refer to figure 2-13.

(1) *Service meter.* Mounted on the left side of the engine and driven by the accessory drive shaft,

the service meter records total engine operating time.

(2) *Air cleaner indicator.* Gives a warning when the air cleaner must be serviced.



ME 3805-249-12/2-13

Figure 2-13. Service meter and air cleaner indicator.

Section IV. OPERATION UNDER USUAL CONDITIONS

2-10. General

The instructions in this section are for the information and guidance of the personnel who will be operating the Model 120 Road Grader. The operator must know how to perform every operation which the grader is capable of executing. This section covers basic operation of the grader, including starting and stopping the engine, putting the grader in motion, and operating the grader.

2-11. Starting the Engine

a. *Preparation for Starting.* Before starting the engine refer to paragraph 3-5 and perform the required daily preventive maintenance services.

b. *Starting.*

Caution: Do not attempt to start the grader by towing or pushing. Extensive damage may be caused to the transmission by a lack of lubrication.

(1) Place the transmission shift lever (9, fig. 2-11) in the neutral position.

(2) Move the governor control lever (6, fig. 2-11) to half speed (straight up) position. Press the accelerator (8, fig. 2-11) down to open the fuel injection valves.

(3) Lift the cover, push down the main disconnect switch and turn to the ON position (at right angles to the operator.)

(4) Depress the clutch pedal (3, fig. 2-11).

(5) Turn the heat / start switch (4, fig. 2-9) to START if ambient temperature is above 60° F or to HEAT for the time specified below.

Ambient temperature	Glow plug heating time
60° F to 32° F	1 minute
32° F to 0° F	2 minutes
Below 0° F	3 minutes

(6) Turn the heat / start switch to START and hold until the engine starts.

Caution: Never operate the starter for more than 30 seconds at a time. Allow two minutes for cooling before using the starter again.

Note. Use of starting fluid, heating the coolant and crankcase or extra battery capacity may be necessary in cold weather. If a starting fluid is used, spray sparingly into the precleaner. Be sure to connect batteries in parallel when using jumper cables.

(7) When the engine starts, run it at low idle speed until oil pressure registers on the gage.

(8) When the oil pressure gage (6, fig. 2-9) indicates normal oil pressure, run the engine at half speed for 5 minutes before applying load. Observe engine gages for proper readings.

(9) Check the engine oil level with the engine idling at normal operating temperature.

(10) Release the clutch after the engine is running smoothly to allow the transmission to come up to operating temperature.

c. *Operating Precautions.*

(1) Do not turn the heat / start switch to HEAT or to START while the engine is warm and running.

(2) Do not turn the main disconnect switch off while the engine is running. Electrical components may be damaged.

(3) Do not continue running the engine if engine gages do not register. Stop the engine and investigate immediately.

2-12. Stopping the Engine

a. *Stopping.*

(1) Whenever possible, stop the grader on level ground. Lower the blade and scarifier.

(2) Depress the clutch pedal, shift the transmission into neutral, and apply the parking brake.

(3) Run the engine at half speed for 5 minutes.

(4) Run the engine at low idle for 30 seconds.

(5) Lift the accelerator up to stop the engine.

(6) Turn the main disconnect switch to OFF and pull it up. Position the cover over the switch and secure with padlock.

(7) Perform the required daily preventive maintenance services described in paragraph 3-5.

b. *Stopping Precautions.*

(1) Do not leave the main disconnect switch on. The battery may discharge.

(2) Always lower the blade and scarifier to the ground when the vehicle is stopped and is to be parked.

(3) Always stop the engine if the vehicle is left unattended.

2-13. Operation of Equipment

Caution: Before putting grader in motion, be sure leaning wheel lock bolt (fig. 2-1) is removed.

a. *Putting the Grader in Motion.*

(1) Start the engine (para 2-11) and allow it to come up to operating temperature.

(2) Check all controls for freedom of

the blade lift levers (1 and 7, fig. 2-12). Raise blade only high enough to clear obstructions.

(5) Release the parking brake lever (10, fig. 2-11) by pulling it back (towards the rear of the operator's compartment).

(6) Depress the clutch pedal (3, fig. 2-11) and shift the transmission into the desired direction of travel. Select the desired speed based on load conditions.

Note. The transmission may be engaged without using the clutch, if desired.

(7) Depress the accelerator (8, fig. 2-11) to obtain desired speed. If a constant speed is to be maintained, set the governor control lever to the desired engine speed and release the accelerator.

b. Changing Engine Speed.

(1) To increase engine speed momentarily, depress accelerator or release decelerator.

(2) To maintain engine speed at a particular level, move governor control to desired setting.

(3) To decrease engine speed momentarily, depress decelerator or release accelerator.

c. Changing Gear Speed or Direction.

(1) To change direction, bring the grader to a

stop, disengage the clutch, shift the transmission to the desired direction and speed with a single smooth motion, release brake and clutch, and depress accelerator.

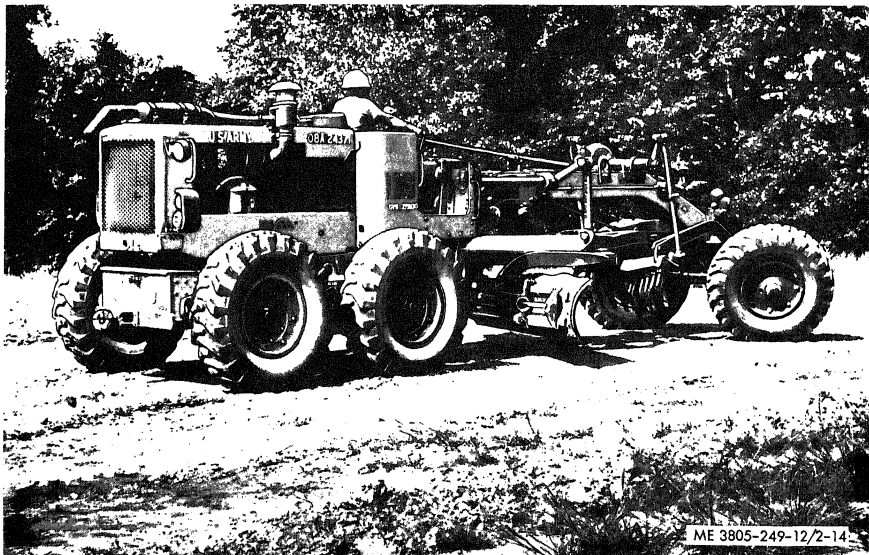
Note. Clutching is not necessary when changing direction at low ground speed, or when making speed selection changes.

(2) To change speed selection, move the transmission control lever with a single quick motion to the desired speed setting. When downshifting under load, increase engine speed to match ratio of lower transmission speed.

(3) Upshift or downshift one speed at a time. When traveling under no load conditions, reduce ground speed before downshifting.

d. Turning the Grader Around.

(1) Lean the wheels in the direction of forward turn (right for a right turn, left for a left turn) as shown in figure 2-14, and travel forward as far as possible. Refer to figure 2-12 for leaning wheel control lever movement.



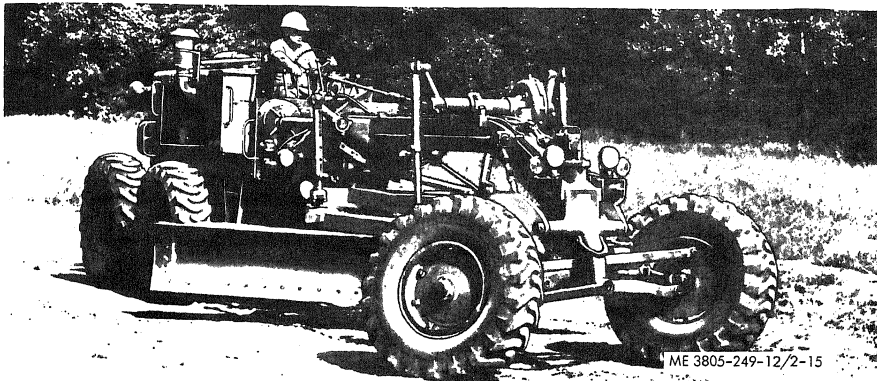


Figure 2-15. Turning grader to left moving backward.

(3) Turn the wheels in the new direction of travel and lean wheels in direction of turn. Straighten wheels for straight ahead travel.

Note. If it is necessary to cross a ditch when turning, back across it. Do not cross it going forward.

e. Stopping and Parking the Grader.

(1) Reduce engine speed.

(2) Start applying the service brakes to reduce ground speed.

(3) Disengage clutch, or shift transmission into neutral.

(4) If engine is to be stopped, set governor control lever at half speed.

(5) Lower blade and scarifier to the ground.

(6) Apply the parking brake, and stop the engine as described in paragraph 2-12.

f. Blade Operating Techniques.

(1) *Right hand leveling.*

(a) Set the sideshift rack so that the left ball socket hole is just left of the left lift drive shaft as shown in figure 2-16.

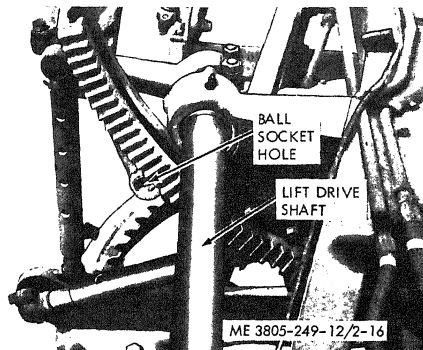


Figure 2-16. Sideshift rack set for right hand leveling.

(f) Set the blade to cast material outside of the left rear wheels. This will maintain a smooth surface for the rear wheels.

(c) Set the blade horizontally at the desired depth of cut.

(d) Lean the wheels to the left to overcome side draft.

(e) Move the grader forward across the area to be leveled. Under good conditions, work the material from side to side. When the area is rough or pitted, plane smooth and respread loose material over the surface.

(2) Left hand leveling.

(a) Set the centershift rack so that the left end is even with the left end of the carrier as shown in figure 2-17.

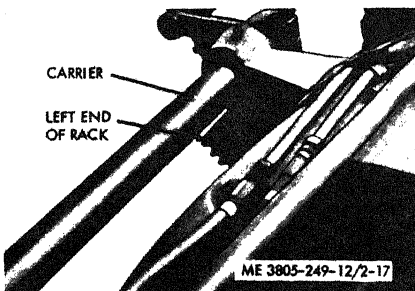


Figure 2-17. Centershift rack set for left hand leveling.

(b) Set the blade to cast material outside the right rear wheels. This will maintain a smooth surface for the rear wheels.

(c) Set the blade horizontally to the desired depth of cut.

(d) Lean the wheels to the right. Proceed with leveling as described for the right hand method, (1) above.

(3) Right hand "V" ditching.

(a) Set the sideshift rack so that the left ball socket hole is just left of the left lift drive shaft as shown in figure 2-16.

(b) Set the blade so that the right end aligns with the outer edge of the right front tire.

(c) Raise the left lift arm to its high position. Angle the blade to deliver material between the wheels.

(d) Lower the right lift arm to set the blade tip for the desired depth of cut.

(e) Lean the wheels to the left. Keep the right front tire in the bottom of the ditch. Make a marking pass and continue ditching to the desired depth.

(2) Right hand leveling.
(a) Set the centershift rack so that the left end is even with the left end of the carrier as shown in figure 2-17.

(b) Set the blade so that the left end aligns with the outer edge of the left front tire.

(c) Raise the right lift arm to its high position.

(d) Lower the left lift arm to set the blade tip for the desired depth of cut.

(e) Lean the front wheels to the right. Keep the left front tire in the bottom of the ditch. Make a marking pass and continue ditching to the desired depth.

(5) Right hand shoulder cleanup.

(a) Set the sideshift rack so that the left end of the rack is between the first two bolts on the left of the carrier as shown in figure 2-18.

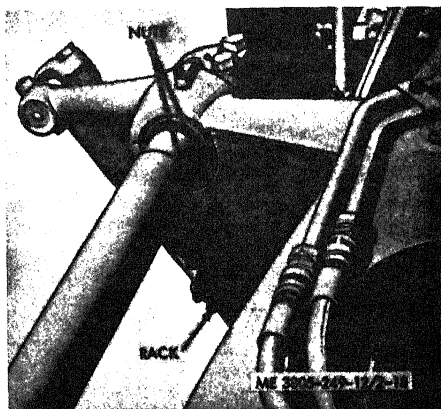


Figure 2-18. Sideshift rack set for right hand shoulder cleanup.

(b) Set the blade so that the right end aligns with the outer edge of the right front tire and material is delivered between the wheels.

(c) Lower both lift arms so that the blade is horizontal at the desired depth of cut.

(d) Lean the front wheels to the left and begin operation.

(6) Ditch back sloping.

(a) Tilt the blade four notches ahead of vertical (para 2-3).


(b) Set the sideshift of the right. Leave at least two or three teeth showing at the left of the pinion.

(c) Set the left link in the bottom hole (para 2-3), and set the right lift link in the top hole (para 2-3).

- (e) Set the heel of the blade in front of the right rear tire.
- (f) Lower the right lift arm to set the degree of slope.
- (g) Lean the wheels toward the slope (right) for a heavier cut or away from the slope (left) for a lighter cut.
- (7) *Right hand ditch cleanup.*
- (a) Set the sideshift rack so that the left end is even with the left end of the carrier (fig. 2-17).
- (b) Set the right end of the blade behind the right front tire.
- (c) Lower the right lift arm to set the blade to the depth of the ditch.
- (d) Set the left lift arm to deliver material onto the slope without cutting.
- (e) Lean the front wheels to the left.
- (f) Move the material up the slope and onto the shoulder. Spread the material and finish final grade.

- (8) *Left hand ditch cleanup.*
- (a) Set the sideshift rack so that the left ball socket hole is just left of the left lift drive shaft (fig. 2-16).
- (b) Set the blade so that the left end is behind the left front tire.
- (c) Lower the left lift arm to set the blade at the depth of the ditch.
- (d) Set the right lift arm to deliver material onto the slope without cutting.
- (e) Lean the front wheels to the right.
- (f) Move material up the slope and onto the shoulder. Spread the material and finish grade.
- Note.* Maintain a $1\frac{1}{2}$ to 1 or a 2 to 1 slope on the backslope.
- (9) *Roadbuilding - "V" ditch method.* Refer to figure 2-19.


STEP 1. DITCH LINE:
LIGHT CUT.




STEP 8. SPREAD TO CENTER.



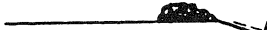
STEP 2. SECOND CUT:
HEAVY.




STEP 9. SLOPE THE BANK.




STEP 3. THIRD CUT:
HEAVY.



STEP 10. CLEAN BOTTOM
OF DITCH.



STEP 4. CLEAN THE
SHOULDER.



STEP 11. DITCHING PASS
TO CLEAN.




STEP 5. LEVEL TO CENTER.



AND SHAPE INSIDE
SLOPE.



STEP 6. FOURTH CUT:
HEAVY.




STEP 12. FINISHING
SHOULDER PASS.



STEP 7. CLEAN THE SHOULDER.



STEP 13. LEVEL AND FINISH.



NOTE
STEPS SHOWN ARE FOR ONE SIDE.
REPEAT ON OPPOSITE SIDE OF ROAD.

ME 3805-249-12/2-19

Figure 2-19. Roadbuilding - "V" ditch method.

of the flat bottom ditch as described in (3) and (4), above.

(b) Tilt the blade four notches ahead of vertical (para 2-3).

(c) Set the sideshift rack so that the left end of the rack is between the first two bolts on the left of the carrier (fig. 2-18).

(d) Position the right front tire in the bottom of the "V" ditch.

(e) Set the blade so that the right end is inside the right front tire at the desired width of the flat bottom ditch.

(f) Lower the right lift arm to set the blade at the desired depth of the cut.

(g) Raise the left lift arm to its high position.

(h) Lean the front wheels to the left. Cut a second "V" ditch to the same depth as the first one.

the bottom hole (para 2-3).

(j) Set the left link in the top hole (para 2-

3).

(k) Set the sideshift rack so that the right end of the rack is slightly above the top of the frame.

(l) Place the right front tire in the bottom of the first "V" ditch.

(m) Set the right end of the blade at the bottom of the backslope.

(n) Lower the right lift arm so that the point of the blade is on the established grade of the ditch.

(o) Lower the left lift arm to the desired depth of the cut. Lean the front wheels to the left.

(p) Set the blade at a sharp angle and move the material up the slope of the ditch.

(q) Spread windrow and finish final grade.

(11) *Roadbuilding - flat bottom ditch method.* Refer to figure 2-20.



STEP 1. FLATTEN INSIDE SLOPE.



STEP 2. LEFT HAND TRENCH CUT TO BOTTOM WIDTH AND DEPTH.



STEP 3. CLEAN THE SHOULDER.



STEP 4. SPREAD TO CENTER.



STEP 5. FINISH BANK SLOPE.



STEP 6. FLAT BOTTOM DITCH CUT.



STEP 7. CLEAN DITCH.



STEP 8. CLEAN INSIDE SLOPE.



STEP 9. FINISHING SHOULDER PASS.



STEP 10. LEVEL AND FINISH.

NOTE
STEPS SHOWN ARE FOR ONE SIDE.
REPEAT ON OPPOSITE SIDE OF ROAD.

ME 3805-249-12/2-20

Figure 2-20. Roadbuilding - flat bottom ditch method.

position (para 2-3).

(b) Extend the left lift link and shorten the centershift link (para 2-3).

(c) Move the moldboard and sideshift rack to the extreme right (para 2-3).

(d) Lower the blade to the desired depth and set at an angle to deliver the material to the side.

(13) High bank cuts.

Note. For a high bank cut, the road bed at the base of the cut must be level.

(a) Set the centershift length to the shortest position. Set the right lift link for slope; use the first hole for a 90° slope and vary to the fifth hole for flatter slopes. Extend the left lift link. Tip the moldboard forward. Refer to paragraph 2-3 for adjustment procedures.

(b) Move the moldboard to the extreme right and the sideshift rack to the right. Refer to paragraph 2-3.

(c) Rotate the circle.

(d) While gradually moving into the cut, lower the left lift arm to set the heel of the blade at the bottom of the slope and at the center of the rear

(e) Lower the right lift arm to set the desired degree of bank slope. For a heavier cut, lean the front wheels toward the slope (right). For a lighter cut, lean the front wheels away from the slope (left).

Note. Keep the material from the slope moving to the outside of the rear wheels.

g. Scarifier Operation.

Caution: When carrying the scarifier in the fully raised position, be careful not to contact the drawbar with the scarifier.

(1) Enter the material gradually while traveling in a straight line.

(2) Keep the scarifier as deep as conditions permit. Match speed to load.

(3) Lift scarifier when turning to avoid damaging the teeth.

(4) Break up paving by digging beneath the surface and lifting the scarifier.

(5) Use all shanks in light material and fewer shanks in heavier material.

(6) Work downhill on grades.

(7) Angle the scarifier for use in hard material.

Section V. OPERATION UNDER UNUSUAL CONDITIONS

2-14. Operation in Extreme Cold

a. *General.* If the grader is to be operated in extremely cold temperatures, certain precautions must be taken to ensure normal operation. The following subparagraphs describe special cold weather maintenance operations.

b. *Cooling System.* Check cooling system for the correct coolant for the lowest temperature expected. Refer to paragraph 2-1. Inspect cooling system thoroughly and correct or report any leaks.

c. *Batteries.* Keep batteries fully charged to prevent freezing. If water is added to the batteries, run the engine at least one hour to mix the electrolyte solution.

d. *Fuel System.* Service the fuel system frequently to keep the fuel tank full. Drain condensation from the tank before and after operation. Drain and service the fuel filter frequently.

e. *Lubrication.* Lubricate all moving parts of the frame and shafts as prescribed in the current Lubrication Order (LO 5-3805-249-12).

f. *Operation.* Start the engine (para 2-11) and allow it to reach normal operating temperature before applying load.

(1) If mud or snow collects and freezes on any of the moving parts while the vehicle is idle, thaw

the frozen material before attempting to operate the grader.

(2) Operate the blade sideshift and steering system with care until hydraulic oil reaches operating temperature.

(3) Check all of the vehicle components for proper operation.

g. Parking.

(1) Park the grader on high ground or under cover if possible. Prepare a footing of planks or brush to keep the wheels from freezing to the ground. Block the wheels and release the parking brake. Place blocks under the blade so it cannot freeze to the ground.

(2) Clean all mud, snow and ice from the grader. If the grader must be parked outdoors, cover with tarpaulins. Keep the ends of the tarpaulins off the ground.

2-15. Operation in Extreme Heat

a. *General.* Continuous operation in high temperatures may cause the grader to overheat. Avoid sustained low gear operation. Observe water temperature indicator and transmission oil pressure gage periodically, and stop the grader for a cooling-off period if either indicates in the red zone.

b. *Cooling System.* Inspect and service the fan and radiator frequently. Keep coolant level within one inch of the top of the radiator. Check grille and radiator fins for accumulation of dust, sand and insects which could block air passages.

(1) Scale and rust form more rapidly in high temperature. Change the coolant each year to keep the corrosion inhibitor at full strength.

(2) If necessary, flush the cooling system periodically to keep passages clean.

(3) Avoid servicing the system with "hard" water. Alkaline materials increase scale and rust formation.

c. *Batteries.* Check electrolyte level daily. Keep electrolyte above the battery plates to prevent damage to the batteries. Use a weaker electrolyte solution than normal. Dilute 1.280 specific gravity electrolyte as issued to 1.200 to 1.240 specific gravity at full charge. Recharge batteries at 1.160 specific gravity. If grader is to stand idle for several days, remove batteries and store in a cool place.

d. *Fuel System.* Service the fuel system. Check the fuel supply for water condensation before filling the fuel tank. Variance in temperature causes condensation in storage drums.

e. *Lubrication.* Lubricate the grader as specified in the current Lubrication Order (LO 5-3805-249-12).

f. *Parking.* Do not park the grader in the sun for long periods. If possible, park under cover.

2-16. Operation in Dusty or Sandy Areas

a. *General.* Operation of the grader may cause dust in almost any area. However, when operating in predominately dusty or sandy areas, additional precautions must be taken.

b. *Cooling System.* Keep cooling system fins and cooling areas clean. Blow out with compressed air as often as necessary.

c. *Fuel System.* Use care when servicing the fuel system to keep dust and sand from entering the tank or filters.

d. *Air Intake System.* Service the air cleaner

and keep the dust cup clean.

e. *Lubrication.* Lubricate the grader according to the current Lubrication Order LO 5-3805-249-12. Lubricate and service the grader more frequently than normal. Clean all fittings before lubrication.

f. *Parking.* Park the grader under cover or cover it with tarpaulins. Place additional covers around the engine components, transmission, and hydraulic pump.

2-17. Operation under Rainy or Humid Conditions

a. *General.* Operation under rainy or humid conditions is similar to operation in extreme heat.

b. *Preservation.* Keep all unpainted surfaces coated with preservative lubricating oil. Cover damaged, painted surfaces with preservative oil or paint to prevent corrosion. Protect cables and terminals with ignition-insulation compound.

2-18. Operation in Salt Water Areas

a. *General.* Salt water and salt water spray can extensively and quickly corrode the grader components.

b. *Preservation.*

(1) When exposed to salt water, wash the vehicle thoroughly and rinse with fresh water.

(2) Coat unpainted surfaces, especially damaged painted surfaces with preservative lubricating oil.

(3) Keep all painted surfaces in good repair.

(4) Lubricate the vehicle as prescribed in the current Lubrication Order LO 5-3805-249-12. Lubricate parts exposed to salt water more frequently than normal.

2-19. Operation at High Altitudes

a. *General.* Normally operation of the grader at high altitudes will be the same as operation in extreme cold.

b. *Cooling System.* Check for overheating. Check the radiator cap for a good seal.

Section VI. OPERATION OF MATERIAL USED IN CONJUNCTION WITH THE EQUIPMENT

2-20. Fire Extinguisher

a. *General.* The dry chemical type fire extinguisher is mounted on a bracket in the operator's compartment.

b. *Operation.* Remove the fire extinguisher from its bracket, remove the safety pin, lift the handle,

press the lever, and direct the powder at the base of the flame using a side-to-side sweeping motion.

c. *Maintenance.* Weigh the fire extinguisher and check the pressure every six months. Replace if weight is less than 4½ pounds or if pressure is below 125 pounds.

CHAPTER 3

OPERATOR'S MAINTENANCE INSTRUCTIONS

Section I. BASIC ISSUE ITEMS

3-1. Tool and Equipment

Tools and equipment issued or authorized for use

with the grader are listed in the Basic Issue Items List, Appendix C of this manual.

Section II. LUBRICATION INSTRUCTIONS

3-2. General

This section contains lubrication instructions to supplement the Lubrication Order LO 5-3805-249-12.

3-3. Detailed Instructions

a. *General.* Keep all lubricants in closed containers and store in a cool, dry place. Prevent

foreign material from contaminating the lubricants. Drain lubricants into suitable containers.

b. *Cleaning.* Keep lubrication points clean. Clean up spills immediately.

c. *Points of Lubrication.* Service the points of lubrication at the required intervals. Refer to the Lubrication Order LO 3805-249-12.

Section III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

3-4. General

To ensure that the grader is ready for operation at all times, it must be inspected systematically so that defects may be discovered and corrected before they result in serious damage or failure. Defects discovered during operation of the unit will be noted for correction to be made as soon as operation has ceased. Stop operation immediately when a deficiency is noted during operation which would

damage the equipment if operation were continued. Record all deficiencies and short comings together with the corrective action taken at the earliest opportunity.

3-5. Preventive Maintenance

Refer to table 3-1 for preventive maintenance services. Sequence numbers indicate the sequence of minimum requirements.

Table 3-1. Preventive Maintenance Checks and Services

Item Number	Interval					Item To Be Inspected	Procedure	Reference
	B	D	A	W	M			
1	1		3			Hydraulic system.	Check oil level.	(para 3-23)
2	2					Engine air cleaner precleaner.	Inspect for dirt.	(para 3-11)
3	3		2			Radiator.	Check coolant level.	(para 3-12)
4	4		1			Engine crankcase.	Check oil level.	(para 3-8)
5	5		4			Fuel tank.	Check fuel level.	(para 3-10)
6	6					Tires.	Check for proper inflation.	(para 3-22)
7		1				Controls and instruments.	Check for proper indication.	(para 1-7)
8				1		Batteries	Check electrolyte level	(para 3-14)

Section IV. TROUBLESHOOTING

3-6. General

Table 3-2 provides information for diagnosing and correcting improper operation or failure of the grader components. Each symptom is followed by a

list of probable causes and possible remedies. Refer any trouble beyond the scope of Operator Maintenance to higher levels of maintenance personnel.

Table 3-2. Troubleshooting

Malfunction	Probable cause	Corrective action
1. Engine cranks but fails to start. 2. Engine hard to start.	Insufficient fuel. a. Insufficient fuel or incorrect grade. b. Insufficient air to engine.	Check fuel tank (para 3-10). a. Check tank and fill with correct grade fuel (para 3-10). b. Service air cleaner (para 3-11).
3. Engine stops suddenly.	Insufficient fuel.	Fill tank (para 3-10).
4. Engine overheats.	Coolant level low.	Check and fill radiator (para 3-12).
5. Engine power low.	Insufficient air to engine.	Service air cleaner (para 3-11).
6. Engine emits black smoke in exhaust.	a. Insufficient air to cylinders. b. Improper fuel.	a. Service air cleaner (para 3-11). b. Service with correct grade fuel (para 3-10).
7. Engine oil pressure low.	a. Crankcase oil level low. b. Oil leak.	a. Fill crankcase (para 3-8). b. Check oil lines. Tighten connections.
8. Air intake system not operating properly.	Clogged air cleaner.	Service air cleaner (para 3-11).
9. Exhaust system not operating properly.	Restricted exhaust pipe.	Inspect and clean.
10. Blade does not operate.	Low hydraulic oil.	Check and replenish as required.

Section V. MAINTENANCE OF THE ENGINE

3-7. Inspection

- Inspect attaching bolts, nuts, screws and clamps for tightness.
- Inspect lubrication and cooling line connections for signs of leakage.
- Inspect hoses and belts for deterioration.
- Inspect housings for chips or cracks.
- Inspect engine components for dents, bends or other damage.
- Inspect oil seals and gaskets for leaks.

3-8. Adding Oil

- With the grader level and the engine running and hot, remove the dipstick (fig. 3-1) and check the oil level. Add oil as necessary to maintain the level between ADD and FULL on the hot check side of the dipstick.

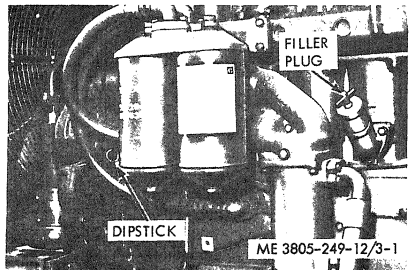


Figure 3-1. Engine oil service.

3-9. Breather Service

a. Disconnect the breather hose (fig. 3-2).

deteriorated.

d. Install the breather and tighten bolt to 8 to 12 ft lbs. Connect the hose.

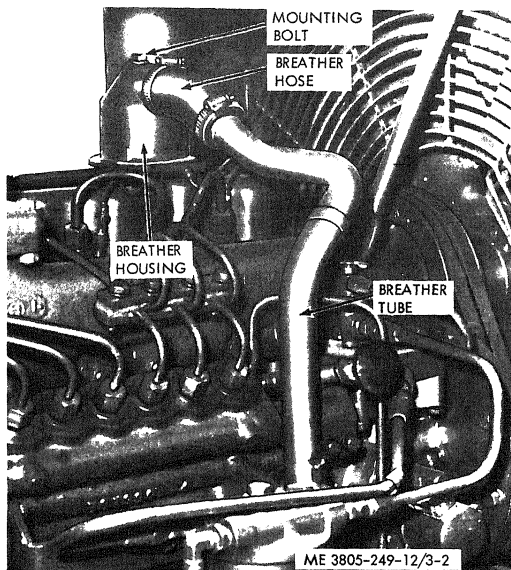


Figure 3-2. Crankcase breather.

Section VI. MAINTENANCE OF THE FUEL SYSTEM

3-10. Fuel System Components

a. *Inspection.* Inspect the fuel tank for signs of damage or leakage. Inspect the cap for damage or a deteriorated seal. Inspect lines for deterioration or leakage. Inspect other fuel system components for leakage.

b. *Service.*

(1) *Adding fuel.* Check the level of fuel in the fuel tank by withdrawing the dipstick. Add fuel as necessary to bring the level to the FULL mark. Always clean the filler neck area before removing the filler cap. Fill the tank at the end of each work day to help prevent moisture from collecting in the fuel system.

(2) *Draining.* Remove the filler cap and the drain plug on the right side of the tank and allow water and sediment to drain.

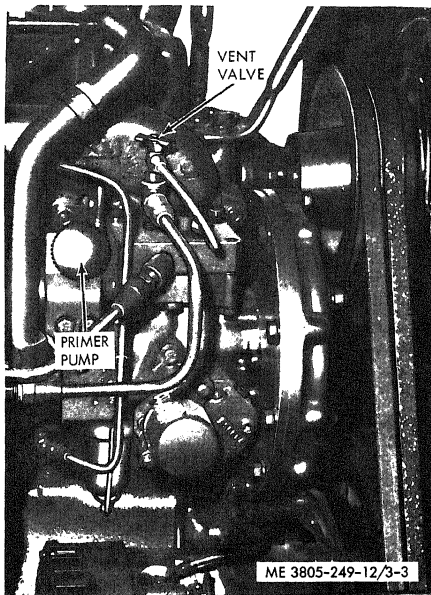
(3) *Cleaning strainer.*

(a) Remove the fuel filler cap. Pry out strainer snap ring and remove the strainer.

(b) Clean the strainer in solvent. Install strainer, snap ring, and cap.

c. *Priming the Fuel System.*

(1) Move the governor control to the OFF position. Open the fuel vent valve (fig. 3-3).



(2) Unlock the primer pump plunger. Operate the plunger until the flow of fuel from the drain tube is free of bubbles.

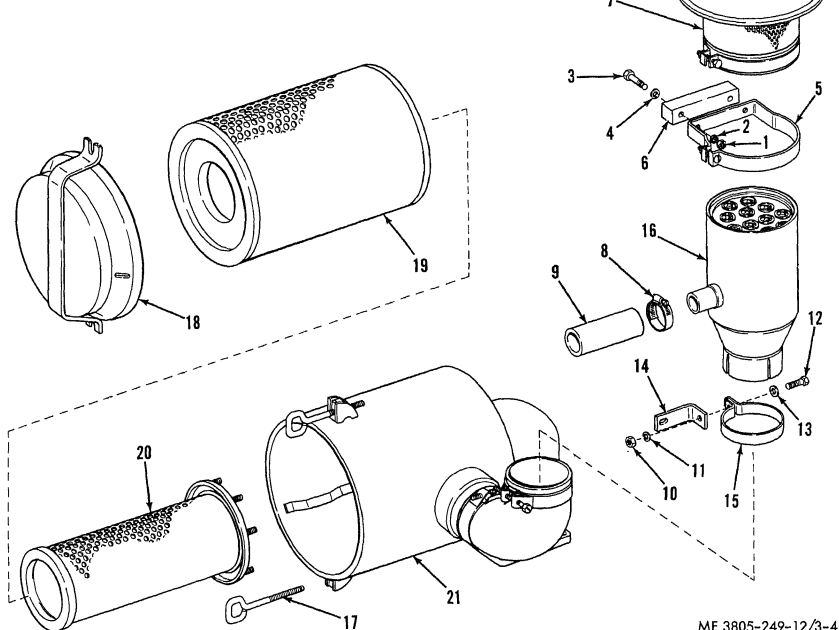
(3) Close the pump, lock the plunger, and close the vent valve. Start the engine and allow to idle for five minutes. Shut down the engine.

3-11. Air Cleaner Service

a. *Precleaner Service.* Refer to figure 3-4.

(1) Remove the clamp (5) and remove the precleaner rain cover (7). Check tube openings for dirt or foreign matter.

Figure 3-3. Priming fuel system.



ME 3805-249-12/3-4

1. Nut
2. Lockwasher
3. Bolt
4. Washer
5. Clamp
6. Block
7. Rain cover
8. Clamp
9. Line
10. Nut
11. Lockwasher

12. Bolt
13. Washer
14. Bracket
15. Clamp
16. Precleaner
17. Eyebolt
18. Cover
19. Primary element
20. Secondary element
21. Body

Figure 3-4. Air cleaner service.

(2) If cleaning is needed, remove the clamp (15) and disconnect the air line (9). Remove the precleaner (16).

(3) Wash the precleaner in warm water and a nonsudsing detergent, or clean with compressed air and a stiff fiber brush. Dry thoroughly.

(4) Reinstall precleaner and rain cover.

b. *Primary Element Service.* Refer to figure 3-4.

Note. Service the primary element if the red band in the air cleaner indicator is locked up.

(1) Remove the air cleaner cover (18) and the primary element (19).

(2) Clean the inside of the air cleaner body. Clean the cover.

(3) Clean the element using one of the following methods:

(a) *Air pressure.* Direct pressurized air (100 psi maximum) along the length of the pleats both inside and outside the element.

(b) *Water.* Direct a flow of water (40 psi maximum) along the length of the pleats both inside and outside the element. Rinse thoroughly and air-dry.

(c) *Detergent.* Wash in warm water and a non-sudsing detergent. Rinse with clean water (40 psi maximum) and air-dry.

(4) Inspect the element by inserting a light inside the clean, dry element. Discard element if it has pinholes or tears.

(5) Record the number of times the element has been cleaned. An element may be cleaned up to 6 or 8 times before it must be replaced.

(6) Install clean element and install air cleaner cover. Reset the air cleaner indicator.

Note. If the indicator shows red shortly after installation of a clean primary element and the element has been

cleaned 6 to 8 times, change the element. If a new primary element is used and the indicator shows red, service the secondary element (subpara c, below).

c. *Secondary Element Service.* Refer to figure 3-4.

(1) Remove the air cleaner cover (18), primary element (19) and secondary element (20). Cover the air inlet opening.

(2) Clean the inside of the air cleaner body (21).

(3) Clean and inspect the secondary element in the same manner as the primary element. Refer to subparagraph b, above.

(4) Uncover the air inlet opening and install secondary element. Secure with nuts and tighten to a torque of 15 to 25 ft-lbs.

(5) Install the primary element (19) and the air cleaner cover (18).

(6) Reset the filter indicator.

Section VII. MAINTENANCE OF THE COOLING SYSTEM

3-12. Radiator

a. *Inspection.*

(1) Inspect the radiator surfaces for corrosion, dents or other damage.

(2) Inspect grille for an accumulation of dirt.

(3) Check hoses for cracks and deterioration.

(4) Inspect the cap for damage or a deteriorated seal.

b. *Service.* With the engine stopped, slowly remove the filler cap to relieve pressure. Use ex-

treme care in relieving pressure to avoid being scalded. Maintain coolant level to the bottom of the fill pipe. Never add coolant to an overheated engine. Refer to paragraph 2-1 for correct coolants.

3-13. Fan Belts Inspection

a. Inspect belts for wear, cracks or fraying.

b. Inspect belt for proper adjustment. Deflection should be 7 / 8 inch when a force of 25 pounds is applied. For new belts, deflection should be 3 / 4 inch.

Section VIII. MAINTENANCE OF THE ELECTRICAL SYSTEM

3-14. Batteries Service

Tilt the seat forward and lift the battery box cover to attain access to the batteries. Maintain electrolyte level to the triangles at the bottom of the

filler opening. At proper charge, the battery will not require more than one ounce of water per cell per week. Keep batteries and terminals clean.

Section IX. MAINTENANCE OF DRIVE COMPONENTS

3-15. Front Wheels Lean Control Housing Inspection

a. Inspect housing for cracks, chips or other damage. Check mounting hardware for security.

b. Inspect fittings for evidence of leakage.

3-16. Transmission and Flywheel Clutch Service

a. To check the oil level, start the engine and remove the dipstick (fig. 3-5). Level should be at the FULL mark on the gage.

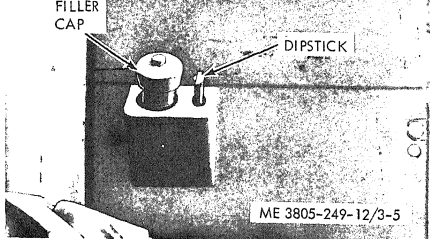


Figure 3-5. Transmission service.

b. Add oil as necessary to maintain the required level. Refer to the current Lubrication Order LO 5-3805-249-12.

3-17. Rear Axle Housing

a. Adding Oil.

(1) Remove the cap at the filler opening at the rear of the axle housing (fig. 3-6).

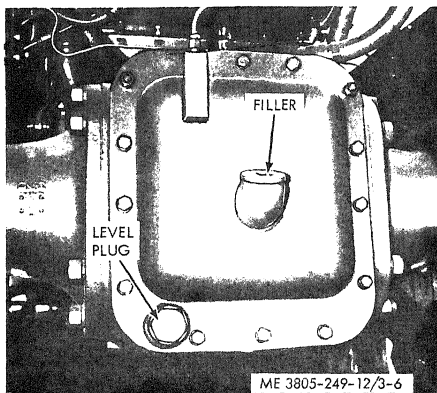


Figure 3-6. Axle housing.

(2) Add oil as necessary to maintain the level to the top of the filler neck. Refer to the current Lubrication Order LO 5-3805-249-12.

b. Breather Service.

(1) Remove the nut securing the breather (fig. 3-7) in position and remove the breather.

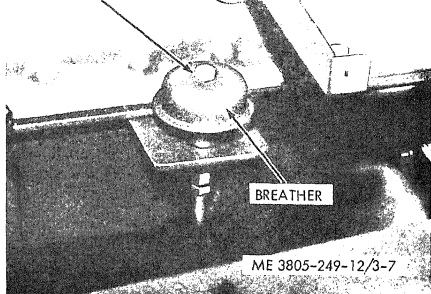


Figure 3-7. Axle breather.

(2) Clean in solvent and blow or shake dry. Oil the element lightly. Reinstall the breather.

3-18. Steering Gear Housing Service

Remove the filler level plug (fig. 3-8) and add oil as necessary to maintain level 1 1/2 inches below the opening. Refer to the Lubrication Order LO 5-3805-249-12 for the correct lubricant. Clean and reinstall the plug.

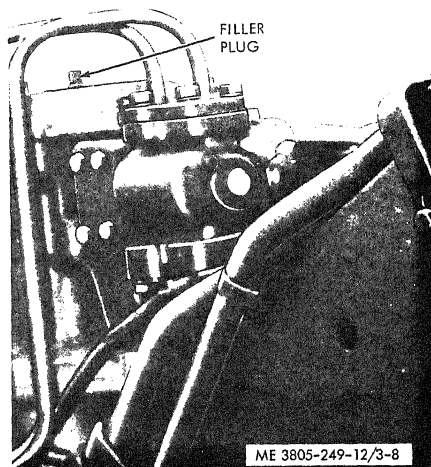


Figure 3-8. Steering gear service.

3-19. Tandem Drive Housings Service

a. *Checking Oil Level.* Check the oil level in the tandem on both sides of the grader. Refer to figure 3-9. Add oil as necessary to maintain the level at the FULL mark on the dipstick.

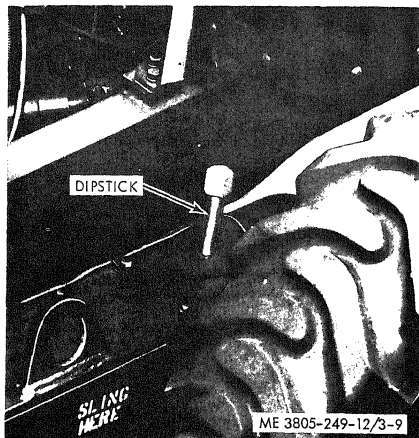


Figure 3-9. Tandem drive housing dipstick.

b. Breather Service.

- (1) Remove the dipstick.
- (2) Remove the element retaining nut in the dipstick and remove the element.
- (3) Clean the element and dipstick in solvent. Ensure the vent in the gage is open.
- (4) Reassemble the breather element to the dipstick and oil the element lightly. Install the dipstick.

3-20. Parking Brake Adjustment

a. *Lever Adjustment.* Place the lever (fig. 3-10) in the disengaged position and screw the knurled knob counterclockwise until the knob is tight. Back knob off four turns.

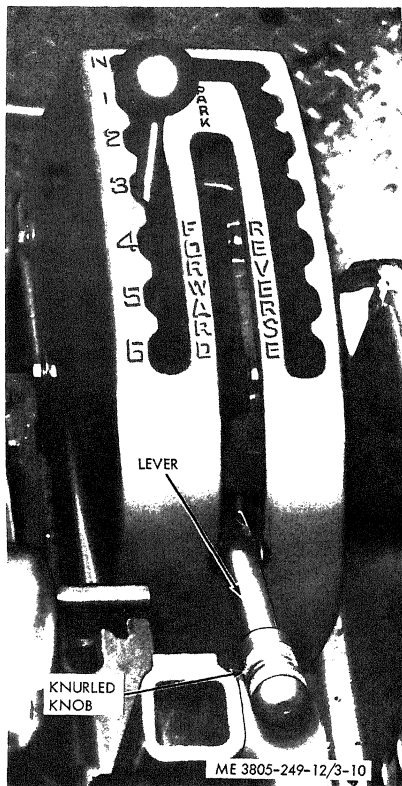


Figure 3-10. Parking brake lever.

b. Linkage Adjustment. Refer to figure 3-11.

- (1) Loosen the linkage clevis locknut.

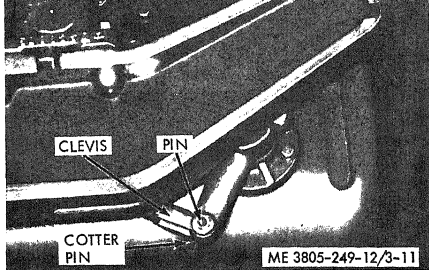


Figure 3-11. Parking brake linkage adjustment.

- (2) Remove the cotter pin from the clevis.
- (3) Remove the pin.
- (4) Remove the clevis from the lever. Screw the clevis onto the cable four full turns.
- (5) Install the clevis, pin, and cotter pin. Tighten the locknut.
- (6) Complete the adjustment with the parking brake lever knob (subpara a).
- (7) Check the adjustment. The lining must be free when the brake is released.

Note. The parking brake is properly adjusted when a reasonably hard pull is required for engagement and when the brake holds the grader.

3-21. Brake Master Cylinder

- a. *Inspection.* Inspect fittings for leakage.

the top of the reservoir housing, located to the right of the brake pedal. Add fluid as necessary to maintain the level $1/2$ inch below the filler opening.

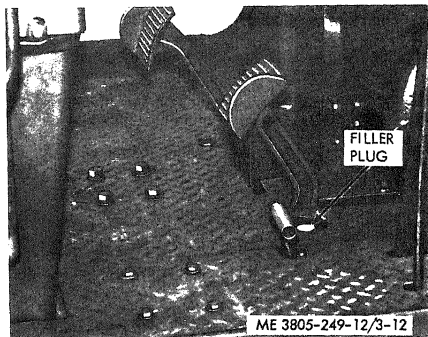


Figure 3-12. Brake master cylinder filler.

3-22. Tires Service

Warning: Use a self attaching air chuck and stand behind the tread when inflating tires.

Check air pressure and maintain at 35 psi, cold inflation pressure.

Section X. MAINTENANCE OF HYDRAULIC COMPONENTS

3-23. Hydraulic Oil Tank Service

- a. With the machine level, the engine off and oil warm, remove the hydraulic filler cap (fig. 3-13). Oil should be visible in the filler opening.

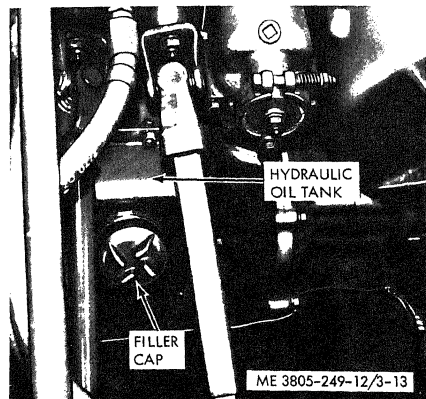


Figure 3-13. Hydraulic filler cap.

b. Add oil as necessary to maintain the proper level. Refer to the Lubrication Order LO 5-3805-

249-12.

Section XI. MAINTENANCE OF EARTHMOVING EQUIPMENT

3-24. Power Control Housing

a. *Inspection.* Inspect power control housing for chips, cracks, or other serious damage. Inspect fittings for evidence of leakage.

b. *Checking Oil Level.* Remove the level plug (fig. 3-14) and check that oil level comes to the bottom of the opening. If necessary, add oil through the plug at the top of the housing. Refer to the Lubrication Order LO 5-3805-249-12.

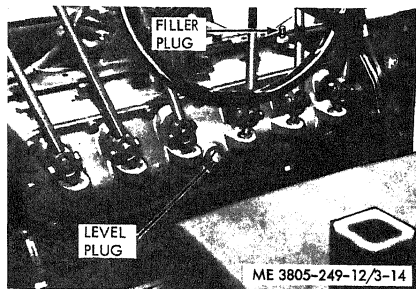
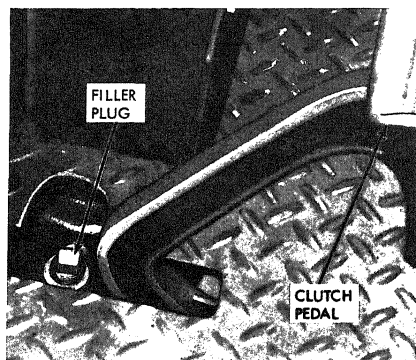


Figure 3-14. Power control housing service.

3-25. Power Control Worm and Gear Housing Service

Remove the filler plug (fig. 3-15) and add oil as necessary until oil is visible in the filler elbow. Install the plug.



3-26. Circle Transfer Gear Housing Service

Remove the filler plug (fig. 3-16) and add oil as necessary to maintain level at the bottom of the filler opening. Clean and reinstall the plug.

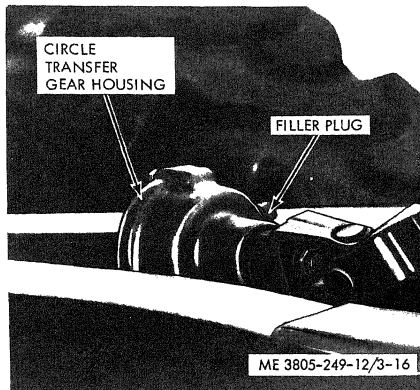


Figure 3-16. Circle transfer gear housing filler plug.

3-27. Circle Reverse Control Housing Service

Remove the filler plug (fig. 3-17) and add oil as necessary to maintain level to the bottom of the filler opening. Clean and reinstall plug.

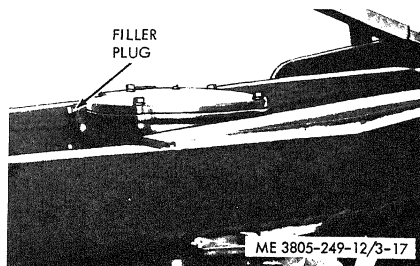


Figure 3-17. Circle reverse control housing filler plug.

3-28. Circle Centershift Control Housing Service

Check the oil level at the filler opening (fig. 3-18).

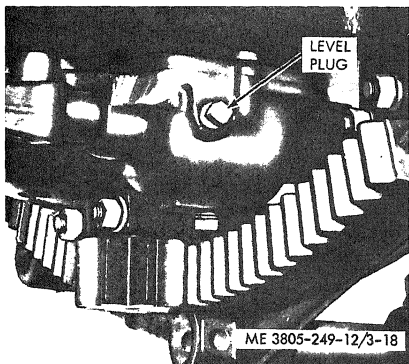


Figure 3-18. Centershift control housing service.

3-29. Blade Lift Control Housings Service

On both blade lift control housings, maintain oil level to the bottom of the level plug opening (fig. 3-19). Filler opening is at the top.

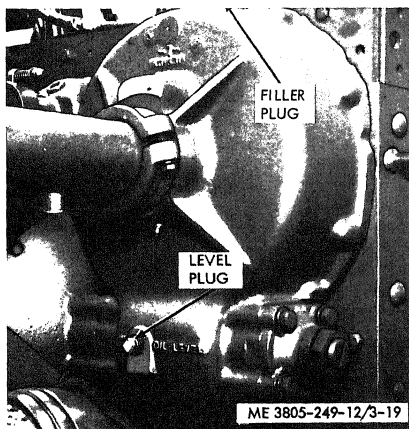


Figure 3-19. Blade lift control housings service.

3-30. Scarifier Control Housings Service

Maintain oil level to the bottom of the level plug

opening in the upper housing (fig. 3-20) and lower housing (fig. 3-21).

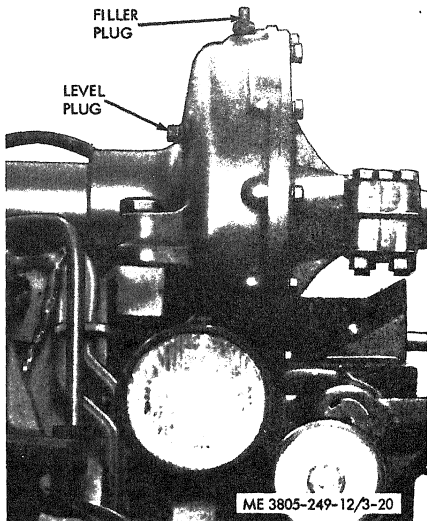


Figure 3-20. Scarifier control upper housing.

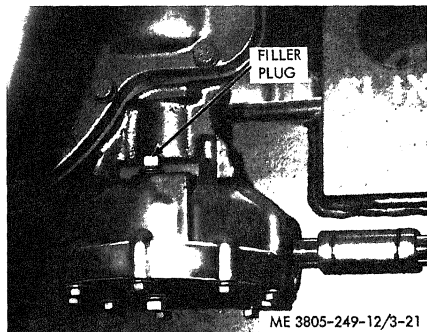


Figure 3-21. Scarifier control lower housing.

3-31. Scarifier Teeth Replacement

Drive off worn or damaged teeth. Install new teeth.

Section I. SERVICE UPON RECEIPT OF MATERIEL

4-1. Inspecting and Servicing the Equipment
No special inspecting and servicing is required of organizational maintenance personnel. Refer to

paragraph 2-1 for operator inspecting and servicing requirements.

Section II. MOVEMENT TO A NEW WORKSITE

4-2. General

a. The grader does not require dismantling before moving to a new worksite.

b. Refer to paragraphs 2-4 through 2-7 for movement instructions.

Section III. SPECIAL TOOLS AND EQUIPMENT

4-3. Tools and Equipment

Tools and equipment issued with, or authorized for, the Model 120 Motorized Road Grader are listed in the Basic Issue Items List, Appendix C of this manual.

4-4. Special Tools and Equipment

No special tools and equipment are required to perform organizational maintenance on the Model 120 Motorized Road Grader.

Section IV. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

4-5. General

The grader must be systematically and periodically inspected for defects to ensure that it is ready for operation at all times. Defects should be corrected before they result in serious damage or failure.

4-6. Preventive Maintenance Services

Refer to table 4-1 for preventive maintenance services. Item numbers indicate the sequence of minimum requirements.

Section V. TROUBLESHOOTING

4-7. Troubleshooting

Table 4-2 provides information for diagnosing and correcting improper operation or failure of the grader components. Each symptom is followed by a

list of probable causes and possible remedies. Refer any trouble beyond the scope of Organizational Maintenance to higher levels of maintenance personnel.

Section VI. RADIO INTERFERENCE SUPPRESSION

4-8. General Methods Used to Attain Proper Suppression

Suppression is attained by providing a low resistance path to ground for any stray currents.

Methods used include shielding the ignition and high-frequency wires, grounding the frame with bonding straps, and using capacitors and resistors.

Table 4-1. Preventive Maintenance Checks and Services

Interval and sequence			Item	Procedure	Paragraph reference
3 months	6 months	1 year			
1			Transmission.	Change filter element. Wash and oil breathers.	4-38
2			Tandem drive housing.	Check oil level. Wash and oil breathers.	4-41
3			Power control housing.	Check oil level.	4-76
			Circle centershift pinion.	Check adjustment.	4-69
	1		Circle centershift pinion.	Check adjustment.	4-78
	2		Blade circle.	Check adjustment.	4-53
		1	Front wheel bearings.	Pack and adjust.	4-75
		2	Circle drawbar ball and socket.	Adjust.	4-13
		3	Flywheel clutch.	Adjust.	4-11
		4	Engine valves.	Check and adjust.	4-25
		5	Cooling system.	Clean.	4-75
		6	Ball and socket joints.	Adjust.	4-50
		7*	Service brakes.	Adjust.	4-79
		8*	Cutting edge and end kits.	Replace.	

* Perform yearly or as required.

Table 4-2. Troubleshooting

Malfunction	Probable cause	Corrective action
1. Engine fails to start.	a. No fuel to engine. b. Defective fuel transfer pump. c. Shutoff solenoid is sticking.	a. Check for empty fuel tank, obstructed lines or clogged filters. b. If fuel pressure is low and filters are clean, replace transfer pump (para 4-15). c. If solenoid makes a clicking sound, replace.
2. Engine misfires.	a. Low fuel supply pressure. b. Broken or leaking line. c. Air in fuel system.	a. Check fuel supply line for obstructions. Service filter (para 4-17). Check fuel pressure. b. Replace the line. c. Locate source of air entry and correct. Bleed system (para 3-10).
3. Engine stalls at low speed.	Low fuel supply pressure.	Check fuel supply line for obstructions. Service filter (para 4-17).
4. Low power.	a. Poor quality fuel. b. Leaks in air intake system. c. Low fuel supply pressure.	a. Drain, clean and bleed fuel system (para 3-10). Replace fuel filter (para 4-17). Fill tank with correct fuel. b. Check air cleaner for restrictions. c. Check fuel supply line for obstructions. Service filter (para 4-17). Check fuel pressure.
5. Excessive vibration.	a. Loose, worn or defective engine mounts. b. Misfiring. c. Unbalanced fan blade.	a. Tighten all mounting bolts securely. Replace damaged items. b. Refer to trouble 2. c. Remove fan belts and operate engine to see if vibration still exists. If not, replace fan (para 4-28).
6. Oil in coolant.	Defective oil cooler core.	Replace (para 4-31).
7. Excessive fuel consumption.	Leaks in fuel system.	Check for leaks and replace leaking components. Service air cleaner (para 3-11).
8. Excessive black or gray smoke.	Insufficient air to engine.	a. Drain excess oil.
9. Excessive white or blue smoke.	a. Crankcase oil level too high. b. Misfiring.	b. Refer to trouble 2.
10. Low engine oil pressure.	a. Engine oil diluted with fuel. b. Clogged oil filter or cooler.	a. Check transfer pump shaft seals. Drain and refill crankcase (para 3-7). b. Service filter or replace cooler (para 4-31).

Table 4-2. Troubleshooting (Continued)

Malfunction	Probable cause	Corrective action
12. Abnormal engine coolant temperature.	a. Defective water temperature regulator. b. Defective temperature gage. c. Coolant level low. d. Air flow through radiator restricted. e. Defective water pump.	a. Test regulator. Replace if defective (para 4-30). b. Replace gage. c. Add coolant. d. Clean outer surface of radiator. e. Replace pump (para 4-27).
13. Electrical system not providing power.	a. Batteries weak. b. Defective cables.	a. Charge or replace (para 4-35). b. Clean and tighten cables or replace.
14. Grader does not steer properly.	c. Defective alternator. a. Oil level low. b. Leaky or defective hydraulic lines.	c. Replace (para 4-33). a. Check and replenish. b. Tighten connections or replace lines.

4-9. Interference Suppression Components

a. *General.* Interference suppression on the grader is achieved by a capacitor mounted on the alternator housing and a capacitor connected to the horn power terminal. Lockwashers ground frame components.

b. *Capacitor Replacement.* Tag and disconnect leads and remove the screws which secure the capacitor in position. Install a new capacitor and connect the leads.

Section VII. MAINTENANCE OF THE ENGINE

4-10. Changing Oil and Filter Element

a. Start the engine. Place the machine on a level surface, allow engine oil to warm up, and shut down the engine.

b. Remove the crankcase filler plug and drain plug (fig. 4-1) and allow the oil to drain. Clean and reinstall the drain plug.

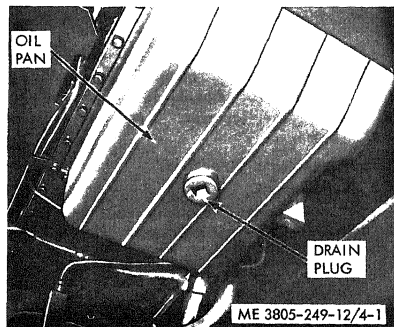


Figure 4-1. Crankcase drain plug.

c. Remove the oil filter housing drain plug (fig. 4-2) and allow the oil to drain.

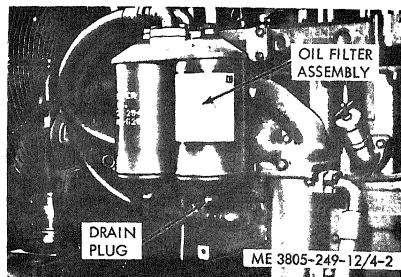


Figure 4-2. Oil filter assembly.

d. Using a strap wrench, spin off the filter. Clean the filter element or replace as required. Reinstall the filter and drain plug.

e. Fill the crankcase to the FULL mark on the cold check side of the dipstick. Refer to the Lubrication Order LO 5-3805-249-12 for the correct lubricant. Crankcase capacity is 7.25 gallons.

f. Install the filler plug. Start the engine and run for two minutes. Check the oil while the engine is running. Maintain the level to the FULL mark on the hot check side of the dipstick.

4-11. Valve Lash Adjustment

a. Remove the crankcase breather (para 4-12) and exhaust hose. Remove the rocker arm cover.

b. Check for a lash of 0.015 inch at the inlet valves and 0.025 inch at the exhaust valves as follows:

(1) Remove the plug from the left rear of the flywheel housing (fig. 4-3). Slowly turn the flywheel to close No. 1 exhaust and inlet valves, and install timing bolt L2070 in the flywheel.

Note. Do not use the starting motor to turn the flywheel.

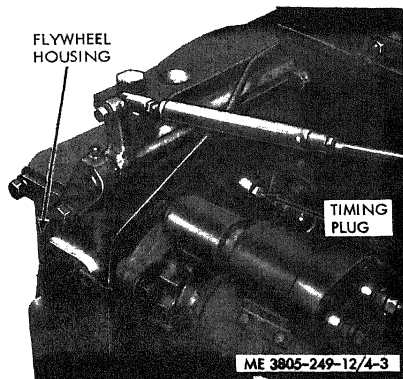


Figure 4-3. Flywheel housing timing plug.

(2) Check the lash of No. 1, No. 3 and No. 5 exhaust valves and of No. 1, No. 2 and No. 4 inlet valves. Adjust as necessary (subpara c).

(3) Remove the timing bolt from the flywheel, turn the flywheel 360 degrees to close the No. 6 exhaust and inlet valves, and reinstall the timing bolt.

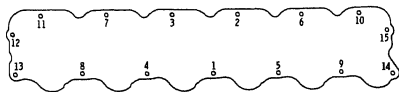
(4) Check the lash of No. 2, No. 4 and No. 6 exhaust valves and of No. 3, No. 5 and No. 6 inlet valves. Adjust as necessary (subpara c).

(5) Remove the timing bolt and install the flywheel housing plug.

(6) Start the engine and run at low idle. Check

for valve rotation. If the valves do not rotate, refer the problem to higher levels of maintenance responsibility.

(7) Shut down the engine and install the rocker arm cover. Tighten the cover retaining bolts to a torque of 6 to 10 ft. lbs. in the sequence shown in figure 4-4. Install the crankcase breather (para 4-12).



ME 3805-249-12/4-4

Figure 4-4. Rocker arm cover bolts torque sequence.

c. Adjust the valve lash as follows.

(1) Loosen the adjusting screw locknut (fig. 4-5).

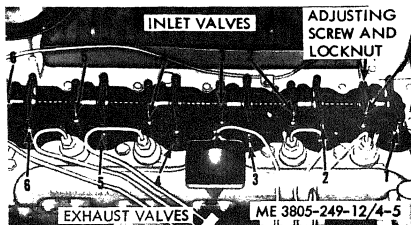


Figure 4-5. Valve lash adjustment.

(2) Turn the adjusting screw clockwise to close the gap and counterclockwise to open the gap.

(3) Check clearance. Hold the adjusting screw the tighten the locknut. Recheck adjustment (subpara b).

4-12. Crankcase Breather

a. Removal.

(1) Disconnect the clamp (fig. 4-6) securing the breather tube to the breather assembly.

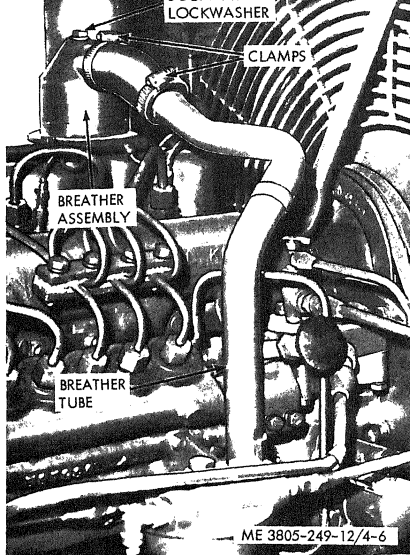


Figure 4-6. Crankcase breather.

remove the breather. Remove the breather tube.

b. Installation. Install the breather assembly and tube by reversing the removal procedure. Tighten breather assembly mounting bolt to a torque of 8 to 12 ft lbs.

Section VIII. MAINTENANCE OF THE CLUTCH

4-13. Pedal and Linkage

a. Removal. Refer to figure 4-7.

(1) Remove the side panel at the transmission

filler plug. Remove four bolts securing the clutch housing inspection hole cover and remove the cover.

(3) Remove the floor plate (para 4-58).
(4) Remove the springs (4 and 5).
(5) Remove the cotter pin (6) and pin (7) securing the rod assembly (3) to the clutch pedal. Remove the rod assembly from the grader by lifting through the floor area.

(6) Remove the nuts (8) and setscrews (9), and slide the rod (10) into the pedal assembly (11) tube. Remove opposite end of the tube from the bracket (12), and remove the pedal assembly from the grader.

b. Installation.

(1) Install the pedal and linkage by reversing the removal procedure.

(2) Install the floor plate (para 4-58).

(3) Adjust the clutch linkage (subpara c).

(4) Install the clutch housing inspection cover and the side panel.

c. Adjustment. Adjust clutch pedal free travel to 1 7/8 inches to 2 inches.

(1) Remove the side panel at the transmission filler plug. Remove four bolts securing the clutch housing inspection hole cover and remove the cover.

(2) Remove the cotter pins from the adjusting nuts and screws. Refer to figure 4-8.

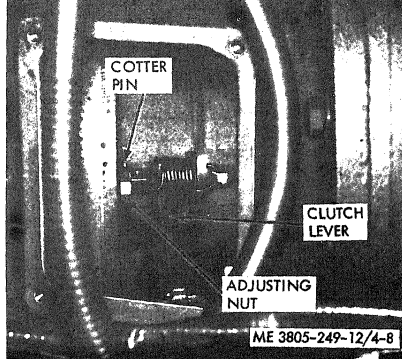


Figure 4-8. Flywheel clutch adjustment.

(3) Turn each adjusting nut in (clockwise) until the levers touch the thrust ring.

(4) Back off the nut to obtain 0.12 ± 0.02 inch clearance.

(5) Check the clearance between the levers and ring. All levers must have the same clearance.

(6) Check the pedal free play.

(7) Install the cotter pins in the adjusting nuts and screws. Install the inspection hole cover and the side panel.

Section IX. MAINTENANCE OF THE FUEL SYSTEM

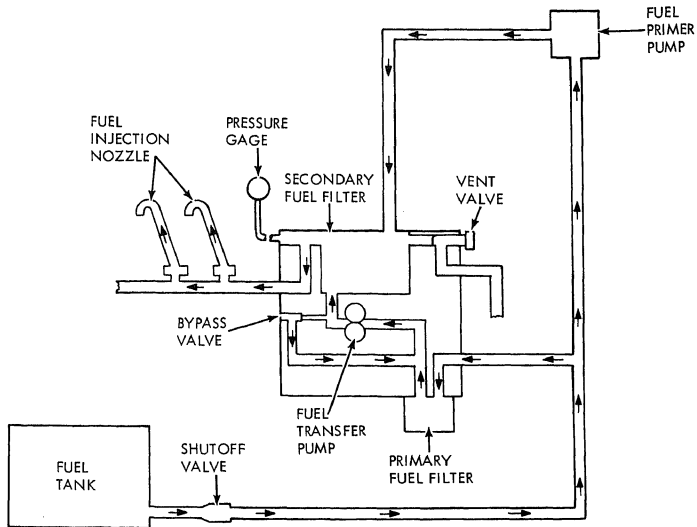
4-14. General

The fuel system consists of a supply tank, fuel injection valve, fuel injection pump, pressure gage, fuel filters, transfer pump, vent valve and primer pump.

The transfer pump draws fuel from the fuel tank and delivers the fuel through the primary and secondary filters to the fuel injection pump. The

injection pump delivers the fuel under high pressure to the injection valves, where it is sprayed into the engine precombustion chambers. Excess fuel not delivered to the injection valves is bypassed to the fuel tank.

Refer to figure 4-9 for a schematic diagram of the fuel system.



ME 3805-249-12/4-9

Figure 4-9. Fuel system schematic diagram.

15. Fuel Transfer Pump

a. *Removal.* Refer to figure 4-10.

(1) Disconnect the drain line, fuel supply line,

and priming pump supply line, cap or plug openings.

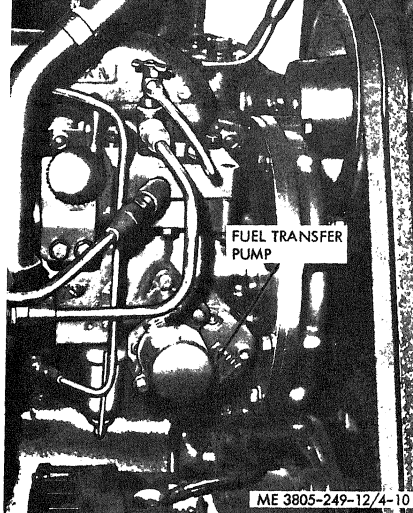


Figure 4-10. Fuel transfer pump.

(2) Remove the bolts and lockwashers securing the fuel transfer pump to the accessory drive housing.

b. *Installation.* Install the fuel transfer pump by reversing the removal procedure. Start the engine and check for fuel leaks.

4-16. Fuel Primer Pump

a. *Removal.* Refer to figure 4-11.

(1) Disconnect fuel inlet and outlet lines. Cap or plug openings.

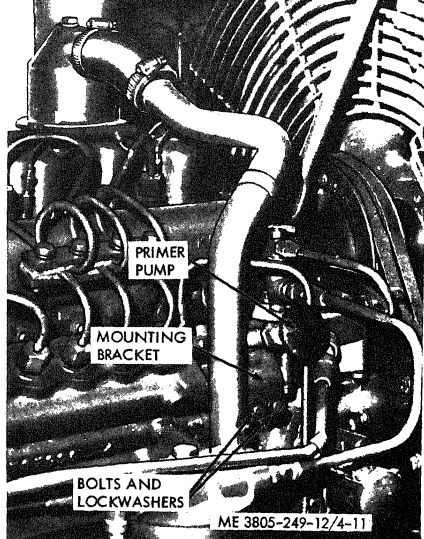


Figure 4-11. Fuel primer pump.

(2) Remove two bolts and lockwashers securing the primer pump mounting bracket to the side of the engine. Remove the primer pump and bracket as an assembly.

(3) Back off the nuts securing the pump sections to the mounting bracket. Separate the pump plunger and body from the bracket.

b. *Installation.* Install the pump by reversing the removal procedure. Actuate the pump plunger and check for fuel leaks.

(1) **Cleaning Primary Filter Element.**

Note. Clean the primary filter element when the fuel gage registers zero while the engine is running.

(a) Close the fuel shutoff valve (fig. 4-12) located under the fuel tank on the right side of the vehicle.

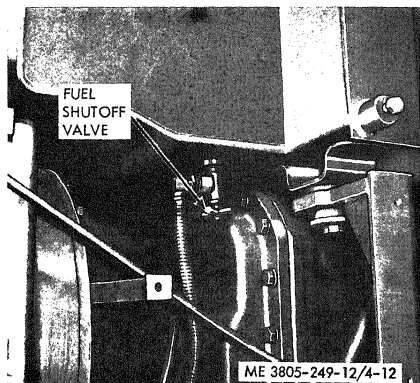


Figure 4-12. Fuel shutoff valve.

(b) Remove the filter bowl and element (fig. 4-13).

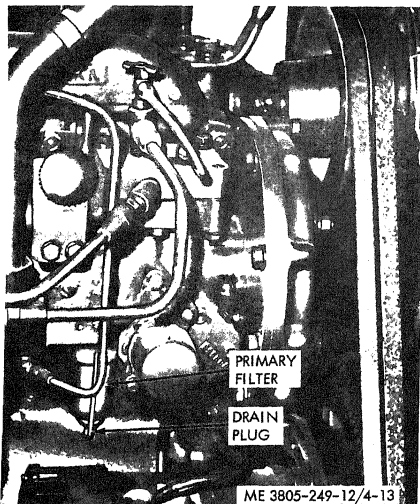


Figure 4-13. Primary fuel filter.

the fuel shutoff valve.

(2) **Changing Secondary Filter Element.**

Note. Replace the secondary filter element if the fuel pressure gage registers zero while the engine is running and if the primary element has been recently cleaned.

(a) Close the fuel shutoff valve (fig. 4-12). Remove the drain plug and allow the filter (fig. 4-14) to drain.

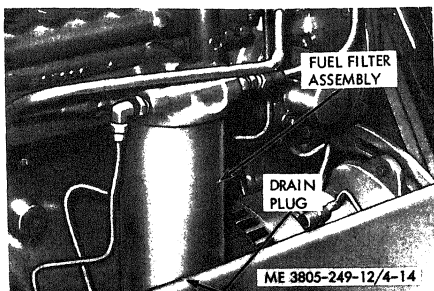


Figure 4-14. Secondary fuel filter.

(b) Using a strap wrench, spin off the filter. Discard the element.

(c) Clean the filter base and gasket surface.

(d) Install a new filter element in the housing and install to the base.

(e) Open the fuel shutoff valve and prime the fuel system (para 3-10). Start the engine and check for fuel leaks.

b. Primary Fuel Filter Replacement. Refer to figure 4-13.

(1) Remove the clamp and unscrew the filter.

(2) Install a new filter.

c. Secondary Fuel Filter Replacement. Refer to figure 4-14.

(1) Close the fuel shutoff valve (fig. 4-12).

(2) Remove the plug at the bottom of the filter housing and allow to drain.

(3) Disconnect the fuel lines at the filter base. Cap or plug openings.

(4) Remove two bolts, lockwashers and nuts securing the filter assembly to the mounting bracket, and remove the filter assembly.

(5) Install a new filter assembly and gasket in the reverse order of removal.

(6) Open the fuel shutoff valve and prime the fuel system (para 3-10).

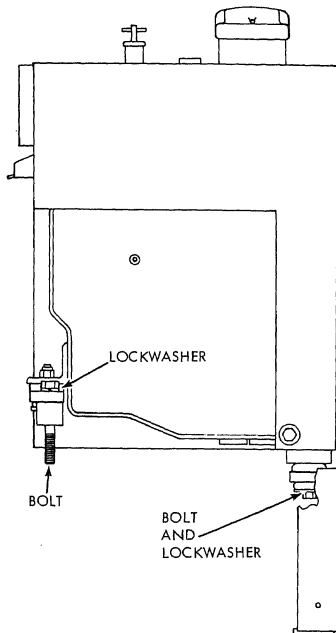
(7) Start the engine and check for fuel leaks.

4-18. Fuel Tank

a. Removal. Refer to figure 4-15.

(1) Remove the hood (para 4-56) and side panels (para 4-57).

(2) Remove the air cleaner indicator line. Cap openings.



ME 3805-249-12/4-15

Figure 4-15. Fuel tank.

(3) Close the fuel shutoff valve and drain the fuel tank. Disconnect fuel lines and cap openings.

(4) Attach a suitable hoist to support the fuel tank.

(5) At the forward end of the tank, remove two nuts, bolts and lockwashers securing the tank to the support assemblies. At the rear of the tank, remove two bolts and lockwashers.

(6) Raise the tank and lift away from the grader. Rest the tank on its forward side.

b. Installation.

(1) Install the tank by reversing the removal procedure.

(2) Open the fuel shutoff valve and service the fuel system.

c. Cap Cleaning. Remove the cap and disassemble. Clean the parts in solvent. Replace damaged or deteriorated components. Reassemble the cap and lightly coat the element with oil. Install the cap.

4-19. Fuel Lines and Fittings Replacement

Replace damaged, deteriorated or otherwise defective lines or fittings with new components.

Section X. MAINTENANCE OF THE AIR INDUCTION AND EXHAUST SYSTEM

4-20. General

The air induction and exhaust system consists of an air cleaner with precleaner, intake manifold (an integral part of the engine), exhaust manifold, exhaust pipe and muffler.

4-21. Air Cleaner

a. Removal. Refer to figure 4-16.

(1) Loosen the clamp securing the precleaner assembly to the air cleaner, disconnect the air line, and remove the precleaner.

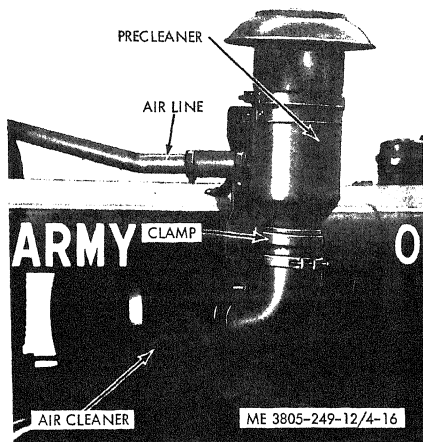


Figure 4-16. Air cleaner.

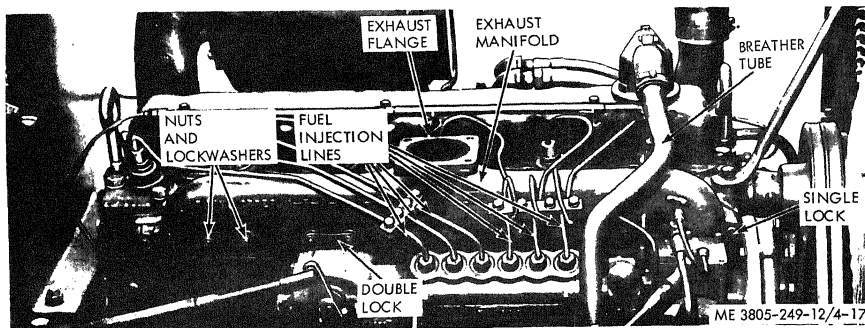


Figure 4-17. Exhaust manifold.

(3) Remove the crankcase breather tube (para 4-12).

(4) Remove four nuts, bolts and lockwashers securing the exhaust tube to the exhaust manifold, and remove the tube.

(5) Remove twelve bolts and lockwashers, five double locks, and two single locks securing the manifold to the cylinder head.

(6) Pivot the left end of the manifold upward to disengage the right end. Remove from the grader. Discard manifold-to-cylinder head gaskets.

securing the air cleaner to the air cleaner exhaust flange. Lower the air cleaner to remove from the grader.

b. Installation. Install the air cleaner by reversing the removal procedure. Tighten mounting nuts to a torque of 15 to 25 ft lbs.

4-22. Exhaust Manifold

a. Removal. Refer to figure 4-17.

(1) Remove the muffler and exhaust pipe (para 4-23) and hood (para 4-56).

(2) Disconnect fuel injection lines. Place caps over openings and nozzles.

b. Installation. Install the manifold by reversing the removal procedure. Apply a sealing compound to the manifold mounting studs and install new gaskets before installing the manifold.

4-23. Exhaust Pipe and Muffler

a. Removal. Refer to figure 4-18.

(1) Remove two nuts and lockwashers securing the precleaner tube to the muffler.

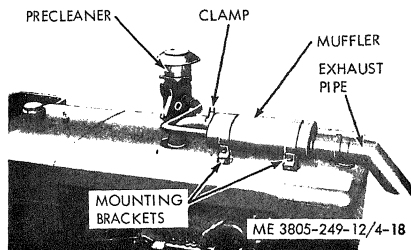


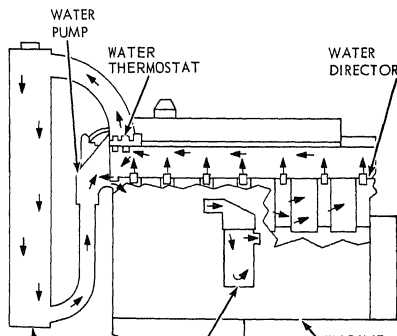
Figure 4-18. Exhaust pipe and muffler.

Section XI. MAINTENANCE OF THE COOLING SYSTEM

4-24. General

The cooling system consists of the radiator, water pump, water thermostat, and oil cooler.

Coolant pumped from the outlet side of the water pump flows directly into the front of the cylinder block and to the oil cooler. The coolant passes through the oil cooler, returns to the block, and flows around the cylinder liner walls to the precombustion chambers. The coolant then flows to the water thermostat. When the coolant becomes sufficiently warm, the thermostat opens to permit the coolant to return to the radiator. The coolant is cooled by air drawn across the radiator core, and is drawn back to the water pump. Refer to figure 4-19 for a schematic diagram of the cooling system.



4-25. Cleaning

Note. Clean the cooling system at least once a year. In areas of hard water, clean system more often. Refer to TB 750-651 for cooling system maintenance instructions.

- a. Run the engine for five minutes. Park the grader on level ground and stop the engine.
- b. Turn the radiator filler cap slowly to relieve pressure, and remove the cap.
- c. Open the radiator drain valve and drain the coolant.
- d. Remove the block drain plug (located left of the oil cooler) and allow to drain.
- e. Close the radiator drain valve and install the block drain plug.
- f. Fill the radiator with a cooling system cleaning solution.
- g. Start the engine and run for 30 minutes. Stop the engine and drain the cleaning solution.
- h. Flush the system with clean water until draining water is clear.
- i. Close the drain valve and fill the radiator with neutralizing solution.
- j. Start the engine and run for 10 minutes. Stop the engine and drain the system.
- k. Flush the system with clean water. Close the drain valve, install the drain plug, and service with coolant.

4-26. Radiator

- a. *Removal.* Refer to figure 4-20.

- (1) Remove the hood (para 4-56) and exhaust pipe and muffler (para 4-23).

- (2) Disconnect wiring to the rear light and remove the light assemblies (para 4-36).

- (2) Remove the nut, bolt and clamp securing the exhaust tube to the muffler.

- (3) Remove two bolts, lockwashers and washers and two bolts securing the muffler retaining strips to their mounting strips. Remove the muffler and exhaust pipe as an assembly.

- (4) To remove the exhaust pipe from the muffler, remove the bolt, nut and clamp.

- b. *Installation.* Install the muffler and exhaust pipe by reversing the removal procedure.

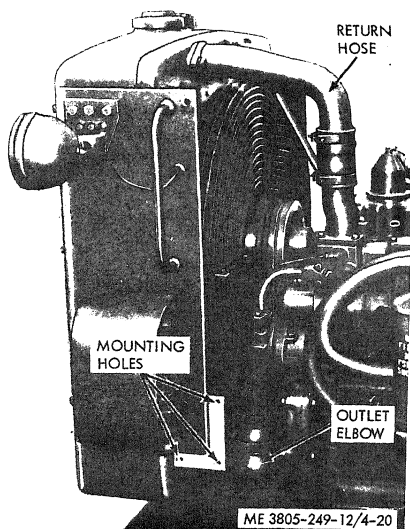


Figure 4-20. Radiator.

(4) Disconnect the upper and lower radiator hoses.

(5) Attach a suitable hoist to support the radiator.

(6) Remove the bolt, washer and lockwasher from each end of the radiator support brace.

(7) Remove four bolts and lockwashers securing each side to the base support bracket.

(8) Remove three bolts and lockwashers securing each side of the radiator guard to the side panels.

(9) Hoist the radiator away from the grader.

b. Installation. Install the radiator by reversing the removal procedure. Service the cooling system. Start the engine and check for water leaks.

4-27. Water Pump

a. Removal.

(1) Drain the cooling system.

(2) Remove the hood (para 4-56).

(3) Remove the radiator (para 4-26) and fan (para 4-28).

Note. The bolts which secure the fan to the pulley also secure the pulley to the adapter. Reinstall two bolts after removing the fan to temporarily secure the pulley to the adapter during pump removal.

(6) Remove the bolts which secure the water pump to the cylinder block, and remove the water pump.

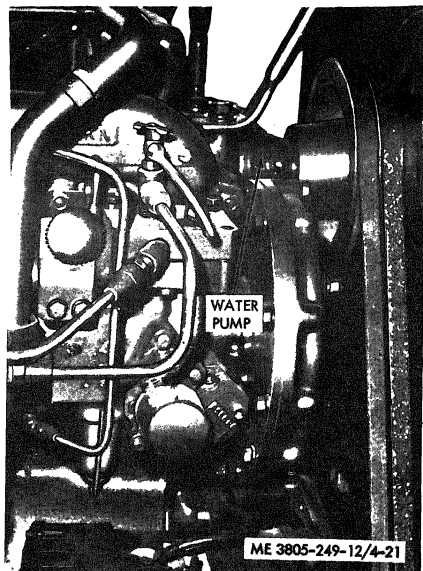


Figure 4-21. Water pump.

b. Installation.

(1) Inspect gaskets and replace if damaged or deteriorated.

(2) Install the water pump by reversing the removal procedure.

(3) Install the fan (para 4-28), belts (para 4-29), and radiator (para 4-26).

(4) Adjust the fan belts tension (para 4-29)

(5) Install the hood (para 4-56).

(6) Service the cooling system. Start the engine and check for leaks.

4-28. Fan

a. Removal.

(1) Remove the hood (para 4-56).

(2) Drain the cooling system and remove the radiator (para 4-26).

(3) Remove six bolts and lockwashers which secure the fan to the impeller shaft, and remove the fan.

(1) Loosen for alternator adjusting strap bolt.

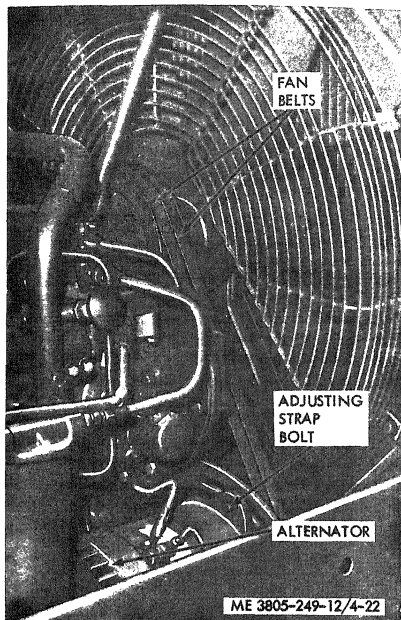


Figure 4-22. Fan belts.

- (2) Remove the old belts by working around the fan. Install new belts.
- (3) Adjust the belt tension (subpara b).

Note. The fan belts must be replaced as a set.

b. Adjustment. Refer to figure 4-22.

- (1) Loosen the alternator adjusting strap bolt.
- (2) Move the alternator in or out as required to attain a deflection of $7/8$ inch at a force of 25 pounds.
- (3) Tighten the adjusting strap bolt.

4-30. Water Thermostat

a. Removal.

- (1) Drain the engine coolant to a level below the thermostat.
- (2) Remove three short bolts and lockwashers and one long bolt and lockwasher securing the water inlet elbow. Refer to figure 4-23.

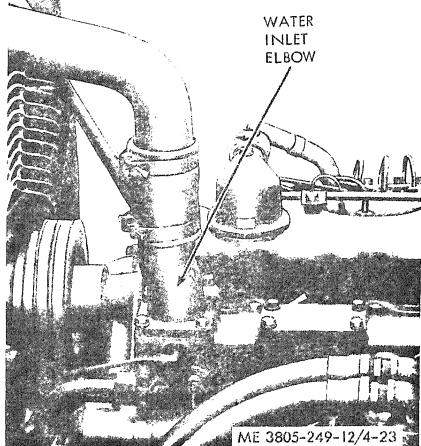


Figure 4-23. Water thermostat removal.

- (3) Remove the inlet elbow and lift out the water thermostat.

b. Testing.

(1) Suspend the thermostat from a wire and completely immerse in a pan of clean water placed on a heater. Do not allow the thermostat to touch the sides or bottom of the pan. Insert an accurate thermometer capable of reading up to 220° F into the water.

(2) Slowly heat the water while stirring gently to distribute the heat.

(3) Observe the thermostat closely. It should begin to open at approximately 170° F and be fully open at 185° F. Replace the thermostat if it does not open at the proper temperature.

c. Installation.

(1) Inspect the gaskets and install new gaskets if necessary.

(2) Install the regulator by reversing the removal procedure.

(3) Service the cooling system and start the engine and check for leaks.

4-31. Oil Cooler

a. Removal. Refer to figure 4-24.

- (1) Disconnect the oil inlet line and oil outlet line. Cap or plug openings.

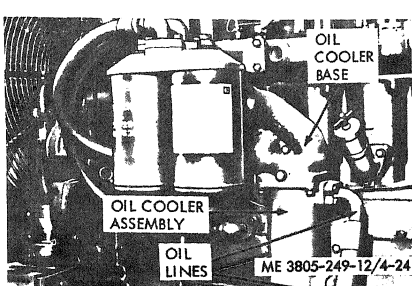


Figure 4-24. Oil cooler.

Section XII. MAINTENANCE OF THE ELECTRICAL SYSTEM

4-32. General

The grader electrical system supplies the power to start the engine and operate the lights and instruments. The system consists basically of batteries, an alternator, starting motor, and wiring, switches and other electrical components. Refer to figure 1-3 for the grader wiring diagram.

4-33. Alternator

a. Removal. Refer to figure 4-25.

(1) Ensure that the master switch is in the off position, and disconnect the battery cables, ground cable first.

(2) Tag and disconnect output and ground wires.

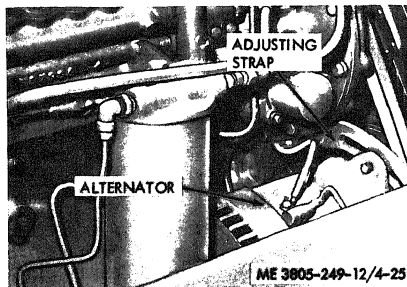


Figure 4-25. Alternator.

(3) Remove the bolt, lockwasher, and two washers which secure the alternator to the adjusting strap.

(4) Remove the bolt, washer and nut

(2) Remove bolts and lockwashers securing the oil cooler base to the engine block, and remove the cooler assembly.

b. Installation. Replace damaged and deteriorated gaskets and install the oil cooler assembly by reversing the removal procedure. Start the engine and check for oil or water leaks.

assembly securing the alternator to the mounting support. Remove the alternator from the grader.

b. Testing.

(1) *Continuous circuit test.* Connect two 12 volt batteries in series with a test lamp. Connect a lead from the batteries to the alternator field terminal and a lead from the test lamp to the alternator output terminal. Refer to figure 4-26. If the lamp does not illuminate, the field coils are open.

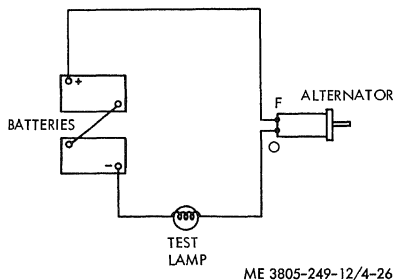
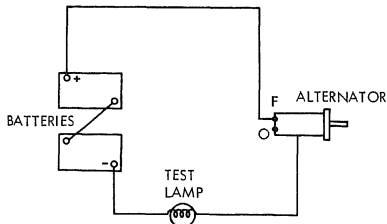


Figure 4-26. Continuous circuit test setup.

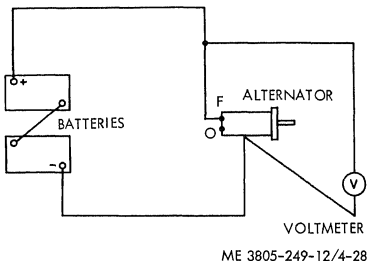
(2) *Ground test.* Connect two 12 volt batteries and a test lamp in series. Connect the lead from the battery to the field terminal of the alternator. Place the lead from the test lamp on the alternator housing. Refer to figure 4-27. If the test lamp illuminates, the fields are grounded.



ME 3805-249-12/4-27

Figure 4-27. Ground test setup.

(3) **Field current draw test.** Connect two 12 volt batteries with an ammeter in series between the alternator field terminal and the field frame. Refer to figure 4-28. Connect a voltmeter between the field frame and field terminal. Run the alternator at approximately 1000 rpm. Check the voltage output. Run the alternator at approximately 2400 rpm and check the voltage drop. Voltage drop must not exceed 0.3% of the output at 1000 rpm.



ME 3805-249-12/4-28

Figure 4-28. Field current draw test setup.

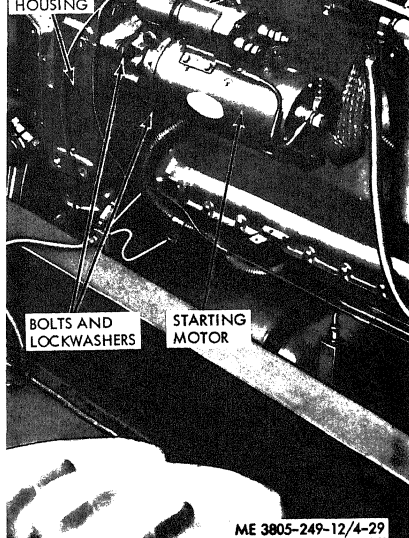
c. Installation. Install the alternator by reversing the removal procedure. Adjust the fan belts (para 4-29). Connect the battery cables.

4-34. Starting Motor

a. Removal. Refer to figure 4-29.

(1) Ensure that the master switch is in the off position, and disconnect the battery cables, ground cable first.

(2) Tag and disconnect cables and wires to the starter and starter solenoid.



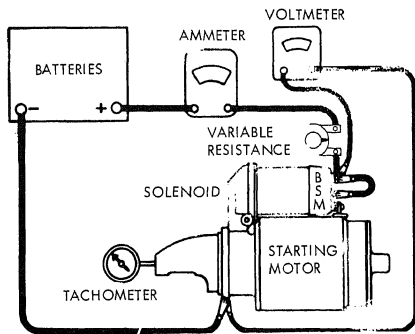
ME 3805-249-12/4-29

Figure 4-29. Starting motor.

(3) Support the starter and remove three bolts and lockwashers which secure the starting motor to the flywheel housing. Remove the starter from the grader.

b. Testing.

(1) Connect the starter in series as shown in figure 4-30. Use batteries known to be fully charged and an ammeter capable of recording 500 amperes.



ME 3805-249-12/4-30

to cool at least 2 minutes between operations.
(2) Vary the resistance to obtain a voltage indication of 20 volts. The ammeter must indicate 45 to 95 amps and the tachometer must indicate 5500 to 7500 rpm. Replace the starting motor if indications do not fall within specified limits.

c. *Installation.* Install the starting motor by reversing the removal procedure. Connect the battery cables.

4-35. Batteries

a. *Replacement.*

(1) Tip the seat forward and open the battery box access cover.

(2) Remove the five wing nuts and lift off the battery hold down.

(3) Disconnect battery cables (ground cable first) and lift the batteries from the box.

(4) Install new batteries by reversing the removal procedure.

b. *Testing and Charging.* Refer to TM 9-6140-200-15, Maintenance of Storage Batteries, Lead-Acid Type, for testing and charging procedures. Use a battery charger-tester.

c. *Battery Cables.*

(1) *Repair.* Clean corrosion from terminals. Repair cracked insulation.

(2) *Replacement.* Replace unusable cables with new cables.

consists of two head lights, two front turn lights, one blackout head light, two front flood lights, one rear flood light, two service stop, turn signals and taillights, and two blackout stop and taillights. Power to the lamps is controlled by the master light switch (fig. 2-10). Flood lamp switches connect power to the flood lights, and the turn signal lever connects power to operate the turn signals.

b. *Replacement.* Disconnect wiring and tag the leads. Remove the attaching hardware securing the housing to the grader frame, and remove the light assembly. Install light assembly by reversing the removal procedure.

c. *Bulb Replacement.* Remove front cover by removing clamp or by removing three screws. Remove the defective bulb and install a new bulb. Install the front cover.

4-37. Wiring and Wiring Harness Repair

a. Replace wiring having broken, frayed or cracked insulation.

b. Resolder or replace broken terminals.

c. Repair shorted connections.

d. Replace broken wires and connections.

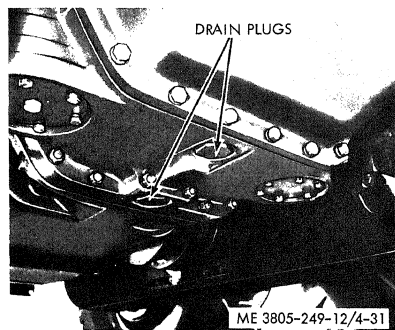
e. Clean corroded terminals with abrasive cloth or replace as necessary.

Section XIII. MAINTENANCE OF TRANSMISSION AND DRIVE COMPONENTS

4-38. Transmission

a. *Changing Oil.*

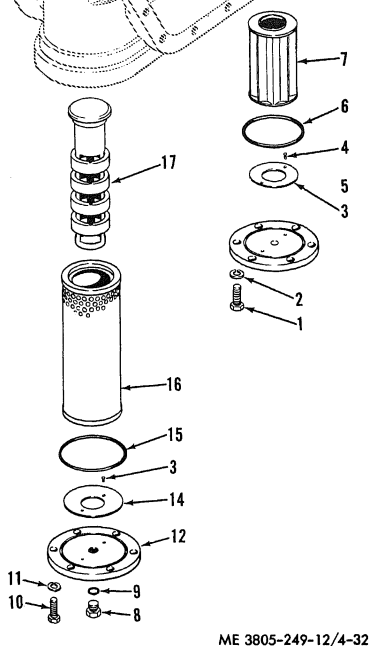
(1) Remove the transmission drain plugs (fig. 4-31) and allow the oil to drain.



(2) Change the filter (subpara b) and service the breathers (subpara c).

(3) Remove the screen cover (3, fig. 4-32), seal (6) and screen (7). Clean the screen and cover components with solvent. Replace the seal (6) if deteriorated. Reinstall the screen and cover.

Figure 4-31. Transmission drain plugs.



ME 3805-249-12/4-32

- | | |
|---------------|----------------|
| 1. Bolt | 10. Bolt |
| 2. Lockwasher | 11. Lockwasher |
| 3. Cover | 12. Cover |
| 4. Capscrew | 13. Capscrew |
| 5. Plate | 14. Plate |
| 6. Seal | 15. Seal |
| 7. Screen | 16. Strainer |
| 8. Plug | 17. Tube |
| 9. Gasket | |

Figure 4-32. Transmission screen and strainer.

(4) Remove the cover (12, fig. 4-32), strainer (16) and tube (17). Clean the strainer and cover with solvent. Clean the tube with a soft, clean cloth. Replace the seal (15) if deteriorated. Reinstall the screen assembly.

(5) Clean and install the drain plugs. Fill the transmission with 20 gallons of oil. Refer to the Lubrication Order LO 5-3805-249-12 for the correct lubricant.

(6) Operate the grader for a few minutes. Recheck oil level and add as necessary.

access cover.

(2) Remove the filter housing drain plug (fig. 4-33) and allow the oil to drain.

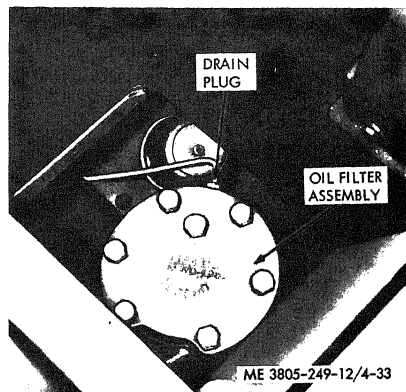


Figure 4-33. Transmission oil filter.

(3) Remove six bolts securing the cover to the housing, and remove the cover and filter element as an assembly.

(4) Remove the nut securing the element to the cover, and discard the element.

(5) Inspect the cover seal. Replace if deteriorated.

(6) Install a new element to the cover. Tighten retaining nut to a torque of 8 to 10 ft lbs.

(7) Install the element and cover and secure with six bolts.

(8) Install the drain plug. Service the transmission breathers (subpara c).

(9) Close the access cover and lower the seat into position.

(10) Start the engine and allow to reach normal operating temperature. Check transmission oil level and add oil as necessary.

c. Breather Service.

Note. The transmission is equipped with two breathers, one on the transmission housing and one on the filler tube. Both breathers should be cleaned whenever the oil filter element is changed.

(1) Housing breather.

(a) Tilt the seat forward and open the oil filter access cover.

(b) Lift off the breather cover (fig. 4-34).

4-39. Shift Control Linkage

a. Removal. Refer to figure 4-36.

(1) Remove the floor plates (para 4-58).

(2) Remove the knobs from the shift lever and the parking brake lever.

(3) Remove the bolts and washers which secure the shift lever housing. Lift housing (1) over the shift and parking brake levers.

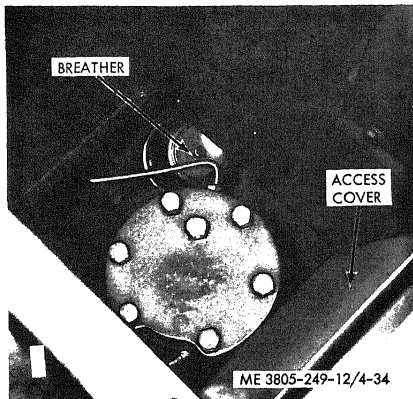


Figure 4-34. Housing breather.

(c) Remove the element and wash in solvent. Lightly oil and reinstall the element.

(d) Install the breather cover. Close the filter access cover and lower the seat into position.

(2) Filler breather.

(a) Remove the side cover from the transmission filler tube.

(b) Loosen the retaining nut and remove the breather assembly (fig. 4-35).

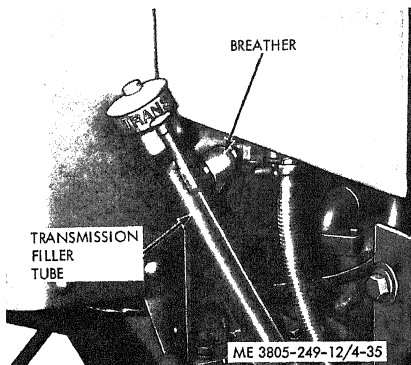
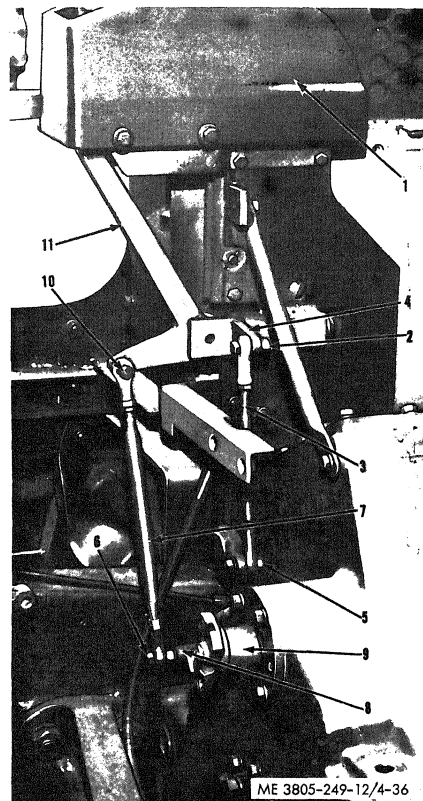


Figure 4-35. Filler breather.

(c) Wash the breather element in solvent. Lightly oil the wire mesh.

(d) Install the breather assembly and secure with the retaining nut.



1. Housing
2. Bolt, lockwasher and nut
3. Rod
4. Shaft
5. Bolt, lockwasher and nut
6. Bolt, lockwasher and nut
7. Rod
8. Key and lever assembly
9. Bolt and nut
10. Bolt, nut, lockwasher and nut

(4) Remove the bolt, lockwasher and nut (2) securing rod (3) to the shaft (4).

(5) Remove the bolt, lockwasher and nut (5), and remove the rod (3) from the transmission housing.

(6) Remove the bolt, lockwasher and nut (6) which secure the rod (7) to the key and lever assembly (8).

(7) Remove the bolt and nut (9) and the key and lever assembly (8).

(8) Remove the bolt, nut, lockwasher and nut (10) which secure the rod (7) to the lever assembly (11) and remove the rod.

(9) Remove the nut and washer (12) which secure the lever assembly to the shift housing support, and remove the lever assembly.

b. Installation. Install the shift linkage by reversing the removal procedure. Install the floor plate (para 4-58).

4-40. Changing Axle Housing Oil

a. Remove the filler cap.

b. Remove the drain plug (fig. 4-37) and allow the oil to drain. Clean and reinstall the drain plug.

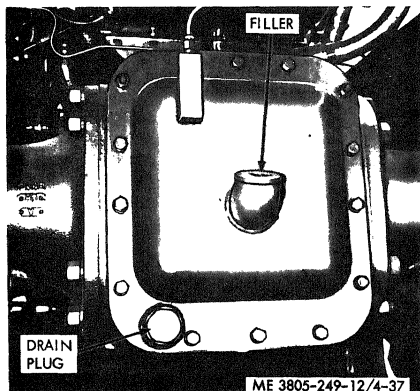


Figure 4-37. Axle housing.

Section XIV. MAINTENANCE OF THE FRONT AXLE

4-42. General

The front axle assembly consists of an axle shaft and a leaning wheel tie bar, lean control housing, two steering knuckles and leaning wheel arms, two

c. Fill the tank to the bottom of the filler opening. Refer to the Lubrication Order LO 5-3805-249-12 for the correct lubricant. Clean and install the filler cap.

4-41. Changing Tandem Drive Housing Oil

a. Remove the magnetic drain plugs (fig. 4-38) and drain oil from both tandem drive housings. Clean and reinstall the drain plugs.

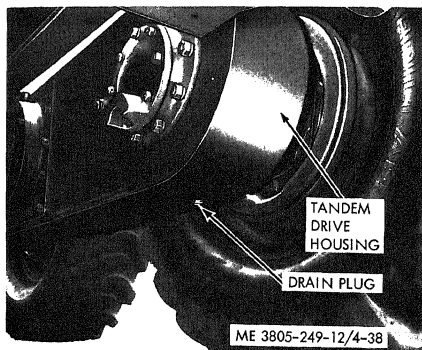


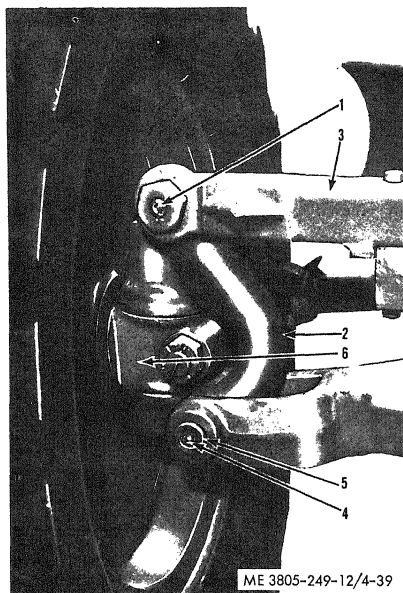
Figure 4-38. Tandem drive housing drain plug.

b. Add oil to the FULL mark on the level gage. Refer to the Lubrication Order LO 5-3805-249-12 for the correct lubricant. Each housing requires six gallons of fluid.

4-43. Steering Knuckle and Leaning Wheel Arm

a. Removal.

(1) Remove the wheel (para 4-53) and tie rod



1. Bolt, cotter pin and nut
2. Arm
3. Tie bar
4. Clamping bolt and lock
5. Pin
6. Knuckle

Figure 4-39. Steering knuckle and leaning wheel arm.

(3) Remove the clamping bolt and lock (4). Drive out the pin (5). Remove the arm (2) and knuckles (6) from the axle.

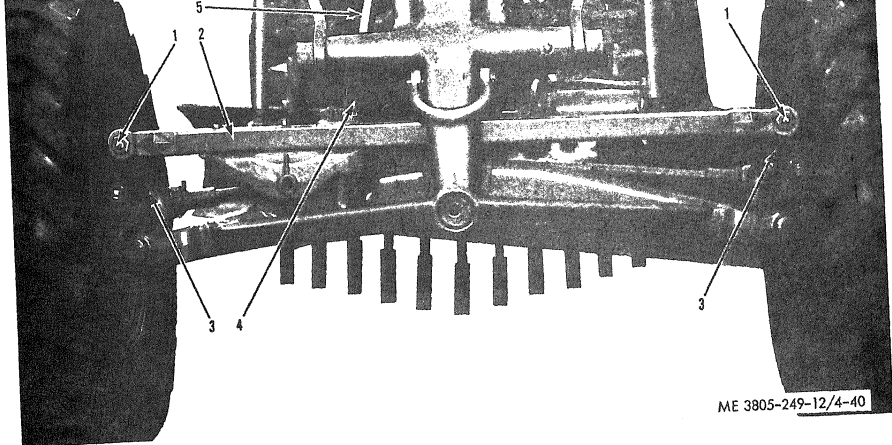
b. Installation. Install the knuckle and arm by reversing the removal procedure. Install the tie rod (para 4-45) and wheel (para 4-53).

4-44. Leaning Wheel Tie Bar

a. Removal.

(1) Support the front end of the grader.

(2) Remove the shoulder bolts, nuts and cotter pins (1, fig. 4-40) which secure each end of the tie bar (2) to the leaning wheel arms (3).



ME 3805-249-12/4-40

1. Bolts, nut and cotter pin
2. Tie bar
3. Leaning wheel arm

4. Cotter pin and washer
5. Link

Figure 4-40. Leaning wheel tie bar.

(3) Remove the cotter pin and washer (4) from the upper end of the link (5).

(4) Move the tie bar forward to clear the link (5) and the leaning wheel pinion.

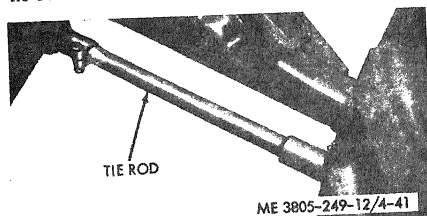
(5) Turn the tie bar so that the gear segment is on top, and remove from the grader.

b. Installation. Install the tie bar in the reverse order of removal. Align the front wheels (para 4-53).

4-45. Tie Rod

a. Removal. Refer to figure 4-41.

(1) Remove cotter pins from each end of the tie rod.



ME 3805-249-12/4-41

Figure 4-41. Tie rod.

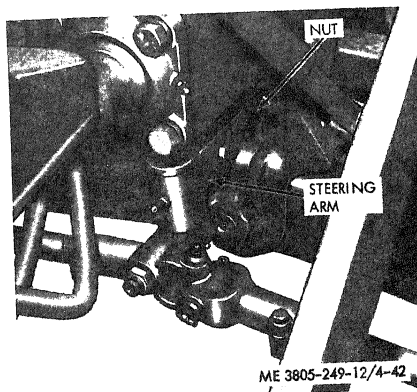
(3) On the inside end of the tie rod, remove the nut, drive out the pin and remove the tie rod.

b. Installation. Install the tie rod in the reverse order of removal.

4-46. Steering Arm

a. Removal. Refer to figure 4-42.

(1) Loosen the nut, but do not remove it.



ME 3805-249-12/4-42

Figure 4-42. Steering arm.

(2) On the outside of the tie rod, drive out the cotter pin.

(2) Mark the position of the steering arm with respect to the pitman shaft.

(3) Insert a pry bar between the nut and the shoulder, and loosen the arm by striking it with a hammer.

(4) Remove the nut. Raise the steering gear approximately three inches to obtain clearance for removing the steering arm.

(5) Remove the nut, cotter pin and cap securing the steering arm to the tie rod connecting block, and remove the steering arm.

b. Installation.

(1) Install the steering arm in the reverse order of removal.

(2) Align the front wheels (para 4-53).

4-47. Lean Control Housing Service

Maintain oil level to the bottom of the filler opening (fig. 4-43). Refer to the Lubrication Order LO 5-3805-249-12 for the correct lubricant.

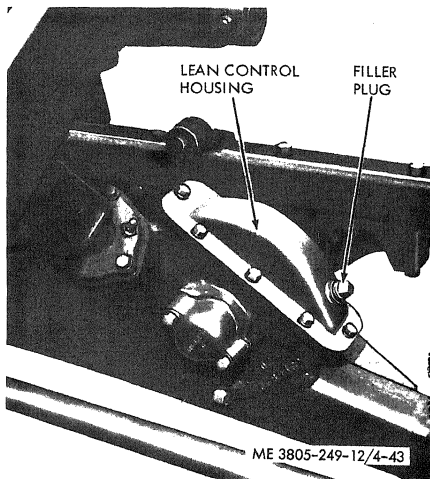


Figure 4-43. Lean control housing filler plug.

Section XV. MAINTENANCE OF THE BRAKES

4-48. General

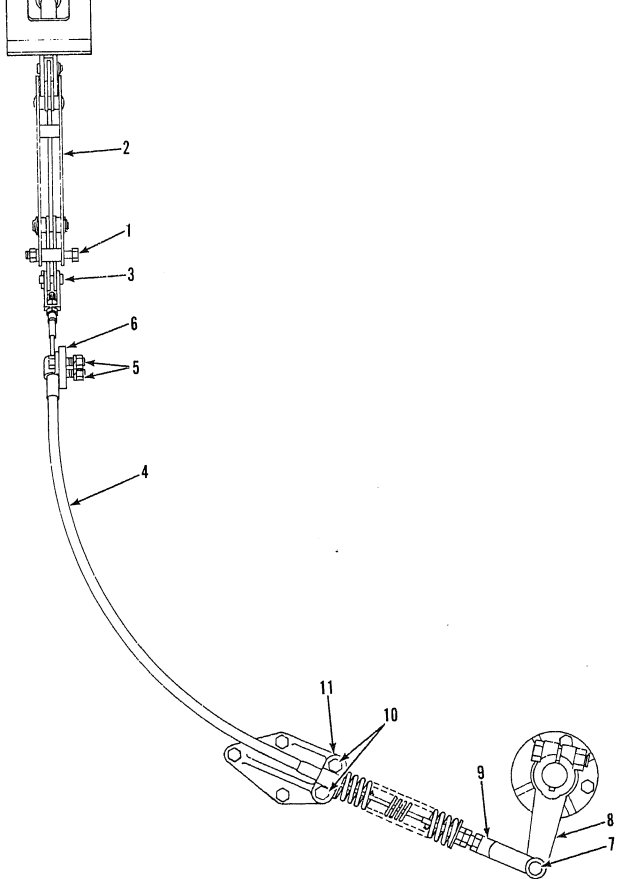
The grader braking system consists of a parking brake and wheel brakes. The parking brake is integral with the transmission and is manually controlled. The hydraulic wheel brakes are mounted on each of the four drive wheels.

4-49. Parking Brake Linkage and Lever

a. Removal. Refer to figure 4-44.

(1) Remove the floor plates (para 4-58).

(2) Remove the knobs from the shift lever and the parking brake lever. Remove the shift lever housing.



1. Bolt, lockwasher and nut
2. Lever assembly
3. Pin and cotter pin
4. Cable assembly
5. Bolt, lockwasher and nut
6. Block

7. Cotter pin and pin
8. Lever
9. End
10. Bolt and lockwasher
11. Clamp

Figure 4-44. Parking brake linkage and lever.

(3) Remove the bolt, lockwasher and nut (1) which secure the lever (2) in position.

(4) Remove the pin and cotter pin (3) which secure the lever to the cable assembly (4). Remove the lever from the grader.

(5) Remove two bolts, lockwashers and nuts, and remove the block (6).

(6) At the transmission flange, remove the cotter pin and pin (7) and separate the lever (8) from the cable end (9).

(7) Remove two bolts and lockwashers (10) and the clamp (11). Remove the cable from the grader.

b. Installation.

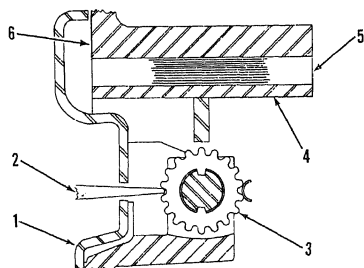
(1) Install the linkage and lever in the reverse order of removal.

(2) Adjust the brake (para 3-20).

4-50. Service Brakes

a. Adjustment. Refer to figure 4-45.

(1) Remove the dust cover from the front of the brake backing plate (1).



ME 3805-249-12/4-45

- | | |
|-------------------|-----------|
| 1. Backing plate | 4. Shoe |
| 2. Adjusting tool | 5. Lining |
| 3. Star wheel | 6. Drum |

Figure 4-45. Service brakes adjustment.

(2) Insert an adjusting tool (2) through the adjustment hole. Rotate the star wheel (3) by pushing down on the tool and moving the brake shoe (4) out until the lining (5) contacts the drum (6).

(3) Turn the star wheel back three notches for used linings or five notches for new linings.

(4) Install the front dust cover and remove the dust cover from the rear of the backing plate. Repeat step (2) for the remaining brake shoe. Reinstall the rear dust cover.

(5) Repeat adjustments for the remaining wheels.

(6) Test the brakes. Check the hydraulic brake fluid level and add as necessary (para 3-21).

b. Bleeding. Air that becomes trapped in the hydraulic brake system should be expelled by bleeding the system. Use a pressure bleeder filled with a sufficient quantity of brake fluid. Maintain the recommended air pressure in the tank while bleeding.

(1) Remove the master cylinder filler plug and connect the bleeder tank.

(2) Attach one end of a hose to the brake bleed screw (fig. 4-46), and place the other end in a clean jar.

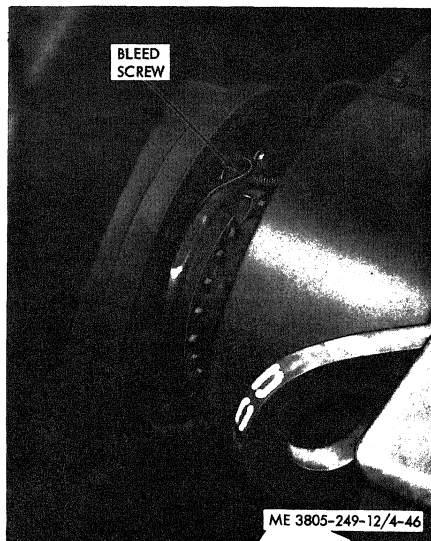


Figure 4-46. Bleeding brakes.

(3) Loosen the bleed screw and allow fluid and air to flow into the jar. When bubble-free fluid begins to flow into the jar, tighten the bleed screw. Remove the hose.

(4) Repeat (2) and (3) for each brake.

(5) Disconnect the bleeder tank and install the master cylinder filler plug.

(6) Check the operation of the brakes. If necessary, adjust as described in subparagraph *a*, above.

lever.

4-52. Brake Pedal and Linkage

a. *Removal.* Refer to figure 4-48.

- (1) Remove the floor plates (para 4-58).
- (2) Remove the return spring.

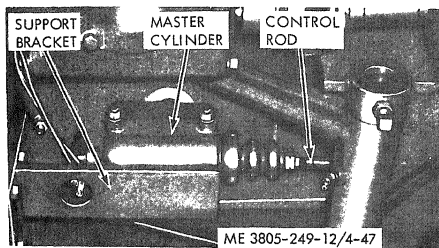


Figure 4-47. Brake master cylinder.

(3) Disconnect the hydraulic brake line at the master cylinder. Cap or plug openings.

(4) Tag and disconnect the wires to the stop light switch on the master cylinder.

(5) Remove two bolts, nuts and lockwashers which secure the master cylinder to the support bracket, and remove the master cylinder.

b. *Installation.*

(1) Install the master cylinder in the reverse order of removal.

(2) Adjust the length of the control rod so that it is 0.125 inch shorter than the length required to align the hole in the yoke with the brake lever hole when the master cylinder and the brake pedal are both in the released position.

(3) Fill the master cylinder with hydraulic

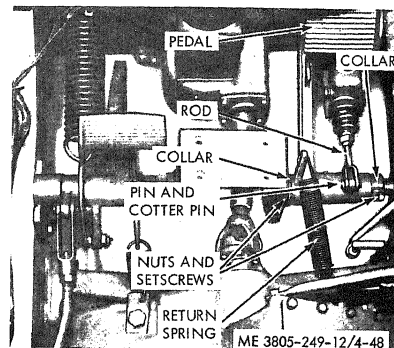


Figure 4-48. Brake pedal and linkage.

(3) Remove the pin and cotter pin which secure the master cylinder rod to the rotary shaft.

(4) At each end of the shaft, loosen the nut and setscrew and slide the collars away from the pedal.

(5) Remove the pedal and shaft as an assembly.

b. *Installation.* Install the brake pedal and linkage in the reverse order of removal.

Section XVI. MAINTENANCE OF THE WHEELS

4-53. Front Wheels

a. *Removal.*

(1) Raise and block the front wheels. Deflate the tire.

(2) Remove the bolts securing the hub cap, and remove the hub cap.

(3) Remove the cotter pin, nut locking pin, and axle nut. Remove the washer and wheel bearing.

(4) Attach a suitable hoist and remove the wheel assembly from the front axle.

b. *Installation.*

(1) Grease wheel cavity and wheel bearing.

(2) Install the wheel, wheel bearing, washer and nut.

(3) Tighten the nut until the bearing seizes. Back off the nut one slot. Ensure that the wheel rotates freely.

(4) Install the nut locking pin and cotter pin.

(5) Install the hub cap and secure with bolts. Inflate the tire.

(6) Rotate the wheel and check for free rotation with no side play.

(7) Lower the front end.

c. *Repacking Bearings.* Remove the front wheel and bearing as described in subparagraph a, above. Clean the bearing and bearing surface and pack grease on the bearing. Install the wheel as described in subparagraph b.

d. Alignment.

(1) Raise the front end of the grader so that the wheels can be rotated freely.

(2) Spin the wheels and draw a band one inch wide around the circumference of the center of the tire.

(3) Spin the wheels again and draw a thin line within the wide band.

(4) Lower the front end and place the wheels in a straight ahead position.

(5) Center the steering gear as follows:

(a) Turn the steering wheel from the extreme right to the extreme left position, counting the number of turns.

(b) Rotate the steering wheel back exactly halfway.

(c) Loosen the locknut on the steering gear housing (fig. 4-49) and turn the adjusting screw clockwise until the backlash in the steering gear is removed. Tighten the locknut.

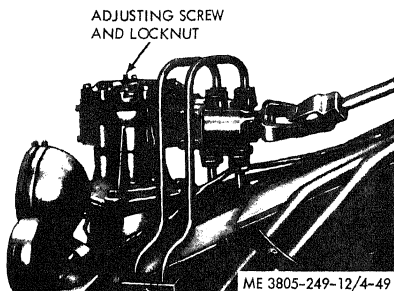
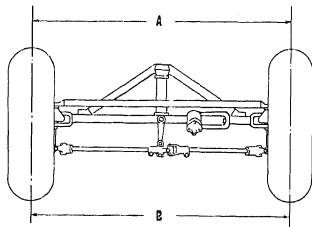


Figure 4-49. Centering steering gear.

(6) Measure the distance (A, fig. 4-50) between the lines at the front of the tires at hub height.



ME 3805-249-12/4-50

Figure 4-50. Front wheel alignment.

(7) Measure the distance (B) at the rear of the tires at hub height. Distance (A) should be 0.12 to 0.25 inch less than distance (B).

(8) If necessary, loosen the clamp bolts in the tie rod ends. Turn the tie rod to obtain proper adjustment. Tighten the clamp bolts.

(9) Move the vehicle forward approximately two feet and perform (6) through (8).

(10) Repeat (9) until proper adjustment is obtained.

4-54. Tires

a. Removal.

(1) Raise the grader just enough to remove the weight from the tire and rim. Deflate the tire.

(2) Remove fourteen nuts and clamps securing the tire and rim to the wheel, and remove the tire and rim as an assembly.

b. Repair.

(1) Repair cuts and punctures by any appropriate method using a Tire Tool Kit.

(3) Use a Valve Repair Tool to replace defective valve cores.

(4) Replace unserviceable tires.

using a Air Service Connector and a Tire Pressure Gauge.

Section XVII. MAINTENANCE OF THE FRAME AND BODY

4-55. Pintle

a. Removal. Remove the four bolts which secure the pintle assembly to the rear frame.

b. Repair. Replace damaged nut or safety chain. Repair damaged weld.

c. Installation. Install the pintle assembly with four bolts and tighten securely.

4-56. Hood

a. Removal.

(1) Remove the exhaust pipe and muffler (para 4-23) and air cleaner (para 4-21).

(2) Remove five bolts, washers and lockwashers which secure the top of the hood to the radiator.

(3) Remove one bolt, lockwasher, nut, and two washers which secure each side of the hood to the radiator support.

(4) Remove the bolt, washer and nut which secure each side of the hood to the fuel tank brackets.

(5) Carefully lift the hood and remove from the grader.

b. Installation. Install the hood by reversing the removal procedure. Ensure that all hardware is securely tightened.

4-57. Engine Side Panels

a. Rear Panel Replacement. Remove the bolts, nuts, washers, and lockwashers which secure the panel to the radiator support, brackets and support. Remove the panel. Install the panel by reversing the removal process.

b. Forward Panel Replacement. Loosen the bolts which secure the rear panel to the forward panel. Remove the bolts, washers and lockwashers which secure the forward panel in position and remove the panel. Install the panel by reversing the removal process, and tighten all hardware securely.

4-58. Floor Plates

a. Removal. Remove the bolts, nuts, lockwashers and washers which secure the three floor plate sections in position. Lift the rear of the plates and slide away from the foot pedals.

b. Installation. Install the floor plates in the reverse order of removal. Tighten nuts securely.

Section XVIII. MAINTENANCE OF THE HYDRAULIC SYSTEM

4-59. General

The grader hydraulic system consists basically of an oil tank, single section pump, pressure relief valve, oil filter and sideshift control valve. The system furnishes hydraulic fluid to operate the steering system and the blade sideshift. Refer to figure 1-4 for the hydraulic schematic diagram.

4-60. Service

a. Park the grader, lower the blade and raise the scarifier. Remove the hydraulic tank filler cap.

b. Remove the hydraulic tank drain hole cover (fig. 4-51) and allow to drain.

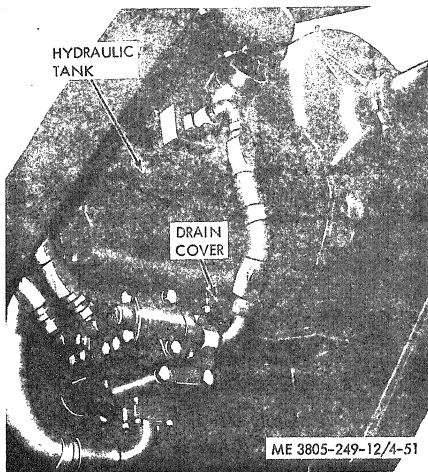
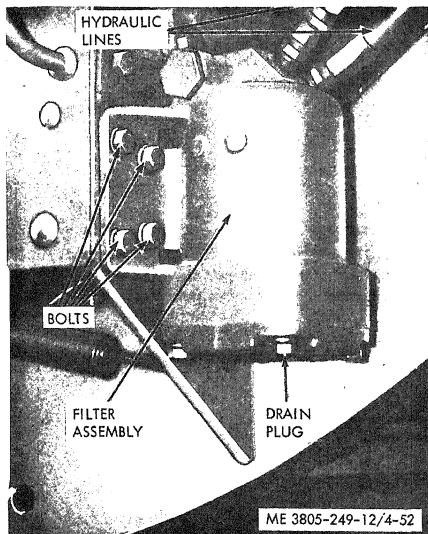


Figure 4-51. Hydraulic tank drain cover.

c. Remove the oil filter drain plug (fig. 4-52) and allow to drain.



d. Lower the scarifier. Remove four bolts securing the filter base to the filter housing. Remove the filter base, spring, seat and element from the housing.

e. Inspect the filter base and plug seals and replace if damaged or deteriorated. Clean the filter housing.

f. Install base, spring, seat and new element in the filter housing and secure with bolts. Clean and install the drain plug.

g. Clean and install the drain cover on the hydraulic tank.

h. Fill the tank to the top of the filler neck. Refer to the Lubrication Order LO 5-3805-249-12 for the correct fluid. Tank capacity is 4.5 gallons.

i. Install the filler cap finger-tight. Start the engine. Raise the blade and scarifier.

j. Remove the filler cap and fill the tank to the top of the filler neck. Install cap loosely.

k. Open the hydraulic cylinder vent valves. Raise and lower the blade until air-free oil flows out of the vent valves. Close the vent valves.

l. Check hydraulic oil level and add as necessary. Install the filler cap finger-tight.

m. Purge air from the system by working the blade and scarifier through several complete cycles.

n. Stop the engine and check hydraulic oil level. Add oil as necessary and install the filler cap tightly. Recheck oil level after a few hours of operation.

4-61. Hydraulic Oil Filter

a. *Removal.* Refer to figure 4-52.

(1) Remove the plug at the bottom of the filter housing and allow oil to drain.

(2) Disconnect the oil inlet and outlet lines. Cap or plug openings.

(3) Remove four bolts which secure the filter assembly in position and remove from the grader.

b. *Installation.*

(1) Install the filter in the reverse order of removal. Tighten bolts securely.

(2) Check the oil level in the hydraulic reservoir and replenish as necessary (para 3-23).

(3) Start the engine and operate the blade through several complete cycles.

(4) Shut down the engine and check for oil leaks.

(5) Check the hydraulic reservoir and service as required.

4-62. Hydraulic Junction

a. *Removal.* Refer to figure 4-53.

(1) Disconnect hydraulic inlet and outlet lines. Cap or plug openings.

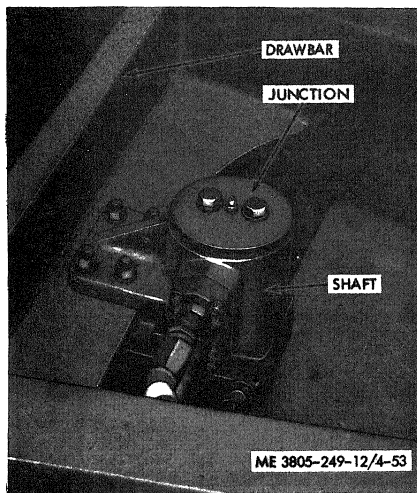


Figure 4-53. Hydraulic junction.

(2) Remove the two cotter pins and washers and remove the pin which secures the shaft of the junction to the guide.

(3) Remove four cotter pins, nuts and lockwashers securing the junction to the drawbar frame.

(4) Hold the junction at the shaft and housing and remove from the grader.

b. Installation.

(1) Install the junction in reverse order of removal.

(2) Start the engine and operate the blade through several complete cycles to expel all air from the system.

(3) Shut down the engine and check for hydraulic leaks.

(4) Check the oil level in the hydraulic reservoir and replenish as necessary.

4-63. Blade Sideshift Control Valve

a. Removal. Refer to figure 4-54.

(1) Disconnect the hydraulic lines at the control valve. Cap or plug openings.

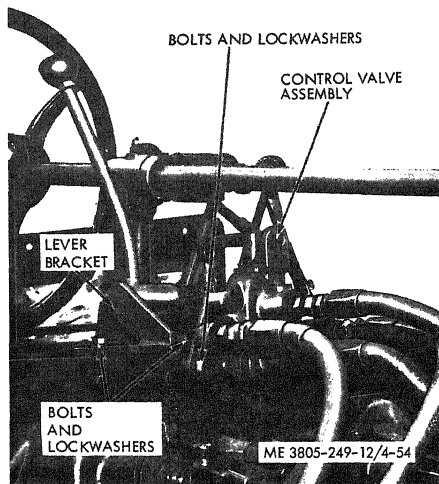


Figure 4-54. Blade sideshift control valve.

(2) Remove two lockwashers and bolts which secure the lever bracket to the dash.

(3) Remove four bolts and lockwashers which secure the valve assembly in position, and remove the valve.

b. Installation.

(1) Install the valve by reversing the removal procedure.

(2) Start the engine and operate the blade sideshift through several complete cycles.

(3) Shut down the engine and check for hydraulic oil leaks.

(4) Check the oil level in the hydraulic reservoir and replenish as necessary.

4-64. Relief Valve

a. Removal. Refer to figure 4-55.

(1) Drain the hydraulic reservoir.

(2) Disconnect the hydraulic lines at the relief valve. Cap or plug openings.

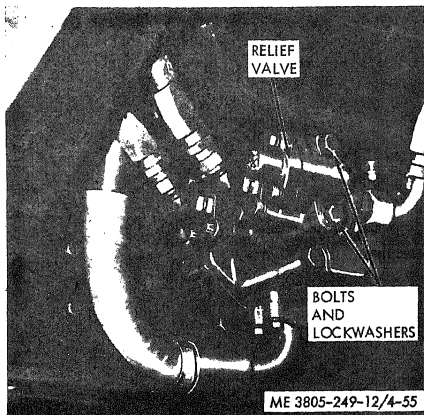


Figure 4-55. Relief valve.

(3) Remove the two bolts and lockwashers which secure the valve body to the base. Remove the body, using care not to let the dump valve slide out of the body.

(4) If the valve base is to be removed, disconnect the hydraulic lines and cap or plug openings. Remove four bolts and lockwashers which secure the base to the hydraulic pump housing, and remove the base.

b. Installation.

(1) Install the relief valve in the reverse order of removal, using a new seal at the mounting face.

(2) Fill the hydraulic reservoir with oil (para 3-23).

(3) Start the engine and operate the blade through several complete cycles. Turn the steering wheel from the extreme left to the extreme right.

(4) Shut down the engine. Check for hydraulic leaks.

(5) Check for oil level in the hydraulic reservoir and replenish if necessary.

4-65. Hydraulic Pump

a. Removal. Refer to figure 4-56.

(1) Drain the hydraulic reservoir and the power control housing

- (2) Remove the relief valve (para 4-64).
- (3) Disconnect hydraulic inlet and outlet lines at the pump. Cap or plug openings.

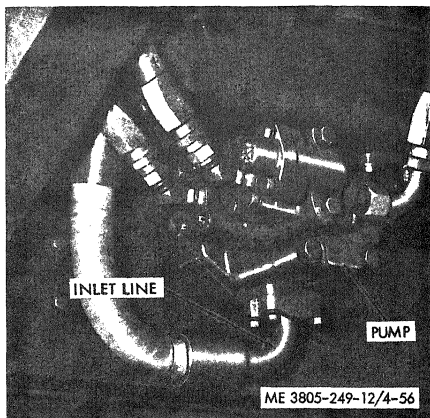


Figure 4-56. Hydraulic pump.

(4) Support the pump and remove the two mounting bolts, nuts and lockwashers. Remove the pump and discard the mounting seal.

b. Installation.

(1) Install the pump in the reverse order of removal, using new mounting seals.

(2) Service the oil reservoir (para 3-23) and the power control housing (para 3-24).

(3) Start the engine and operate the blade and steering wheel through several complete cycles.

(4) Shut down the engine and check for hydraulic oil leaks.

(5) Check the oil level in the hydraulic reservoir and the power control housing and replenish as necessary.

4-66. Hydraulic Oil Tank

a. Removal. Refer to figure 4-57.

(1) Drain the tank.

(2) Disconnect the hydraulic lines at the tank. Cap or plug openings.

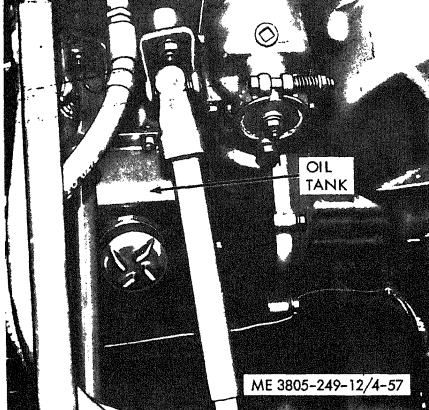


Figure 4-57. Hydraulic oil tank.

Section XIX. MAINTENANCE OF EARTHMOVING EQUIPMENT

4-67. General

The earthmoving equipment consists of the blade and scarifier and the controls, gears and shafts required to operate them.

the frame. Remove from the grader.

b. Installation.

- (1) Install the tank in the reverse order of removal. Tighten bolts securely.
- (2) Service the hydraulic system (para 3-23).
- (3) Start the engine and work the hydraulic controls through several complete cycles.
- (4) Shut down the engine and check for hydraulic oil leaks.
- (5) Check the level of oil in the tank and replenish if necessary.

4-68. Blade Lift Controls

- a. *Lift Arms Replacement.* Refer to figure 4-58.

- (1) Lower the blade to the ground.
- (2) Support the lift link assembly with a hoist.

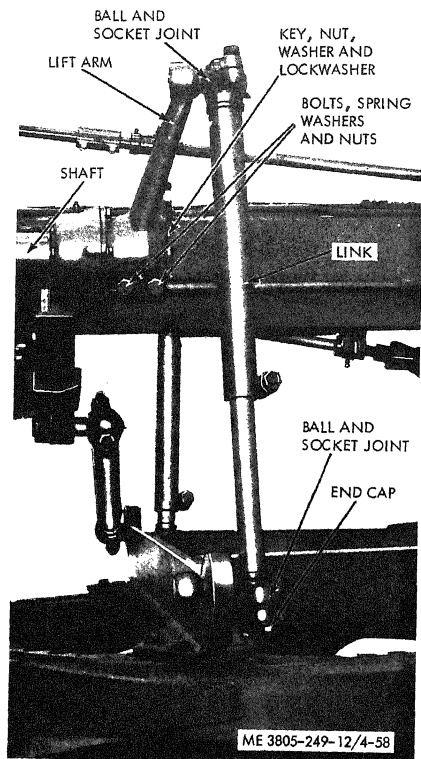


Figure 4-58. Lift arm and link.

(3) Remove two bolts and lockwashers at the ball and socket joints at both ends of the link. Remove the end caps and shims. Lower the link to the ground.

(4) Support the lift arm.

(5) Remove the key, nut, washer and lockwasher.

(6) Remove the bolt, spring, washer and nut. Remove the lift arm from the shaft.

(7) Install the lift arm in the reverse order of removal.

(8) Adjust the end clearance (subpara. b)

b. *Blade Lift Shaft Adjustment.* Refer to figure 4-59.

(1) Loosen the setscrews in the collar.

(2) Insert a bar behind the lift arm and move the shaft as far forward as possible.

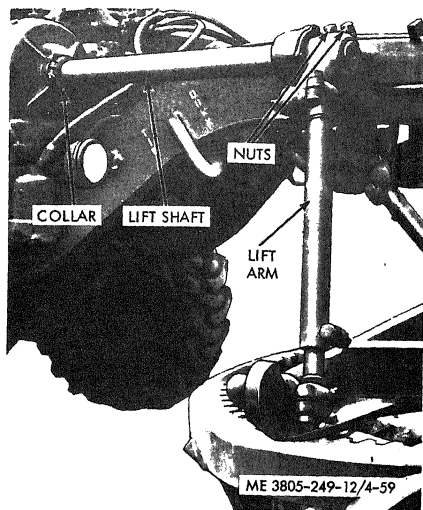


Figure 4-59. Lift shaft adjustment.

(3) Insert a 0.001 or 0.005 inch thickness gage between the collar and the lift control housing. Move the collar against the gage. Tighten the setscrew.

(4) Loosen the bolts at the lift arm.

(5) Move the shaft as far forward as possible and hold in position.

(6) Insert a 0.001 to 0.005 inch thickness gage between the lift arm and bearing assembly. Move the lift arm against the gage and tighten the bolts securely.

c. *Blade Lift Control Brake Repair.* Refer to figure 4-60.

(1) Loosen the adjustment nut and unscrew the anchor bolt. Remove the brake shoes.

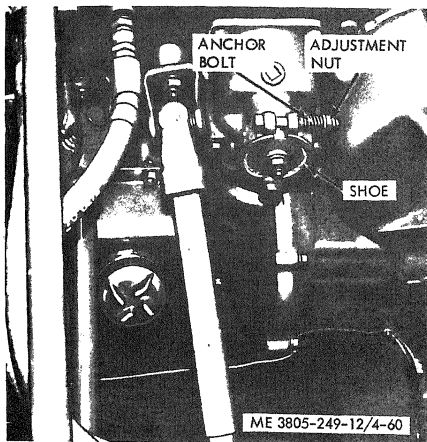


Figure 4-60. Blade lift control brake.

(2) Inspect the shoes, linings and block. Replace if damaged or badly worn.

(3) Install the shoes and secure with the anchor bolt.

(4) Adjust the blade lift worm to remove end clearance (subpara e).

(5) Adjust the brake (subpara d).

d. *Blade Lift Brake Adjustment.* Adjust one brake at each blade lift control housing. Tighten the adjusting nut (fig. 4-60) until the lining contacts the brake block. The nut is self-locking.

e. *Blade Lift Worm Gear Adjustment.* Adjust the blade lift worm gears at both blade lift control housings. Loosen the locknut (fig. 4-61) and turn in the adjusting screw until it bottoms. Hold the screw and tighten the locknut.

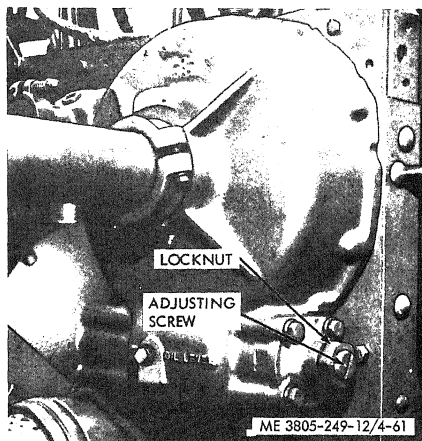


Figure 4-61. Worm gear adjustment.

f. *Blade Lift Control Housings Oil Change.*

(1) Remove the filler plugs and drain plugs from both housings (fig. 4-62). Allow the oil to drain. Clean and reinstall drain plugs.

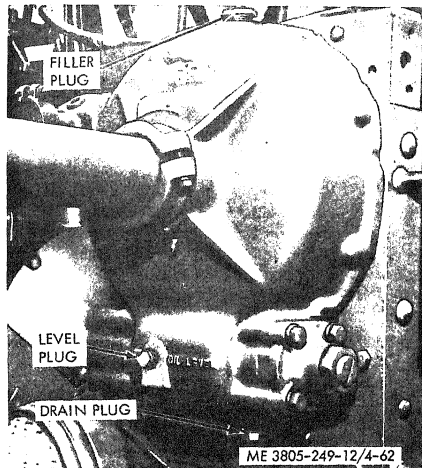


Figure 4-62. Blade lift control housing.

(2) Remove the level plugs and fill to the bottom of the level opening. Refer to the Lubrication Order LO 5-3805-249-12 for the correct lubricant. The capacity of each housing is one gallon. Clean and install plugs.

4-69. Circle Centershift Controls

a. *Centershift Rack Replacement.* Refer to figure 4-63.

(1) Disconnect the link.

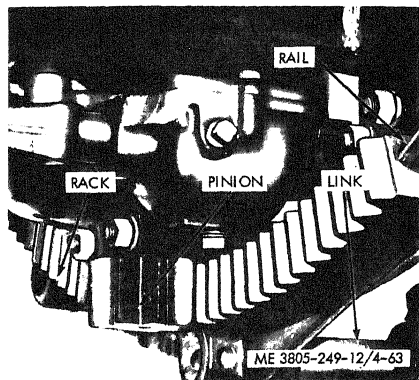


Figure 4-63. Centershift rack.

(2) Start the engine. Engage the circle centershift clutch and sideshift the rack until it disengages the pinion. Shut down the engine.

(3) Attach a suitable hoist and lift the rack from the rail.

(4) Install the rack in the reverse order of removal.

(5) Adjust the centershift drive pinion-to-rack backlash (subpara c)

b. *Circle Centershift Control Housing Replacement.* Refer to figure 4-64.

(1) Remove the drain plug and allow oil to drain from the housing.

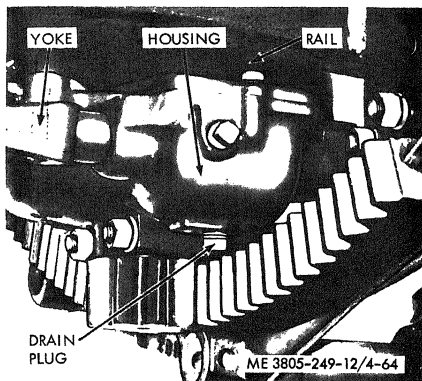


Figure 4-64. Circle centershift control housing.

(2) Remove the nut and washer which secure the yoke to the shaft.

(3) Support the housing and remove the six bolts which secure the housing to the frame.

(4) Remove the housing. Retain the shims located between the housing and the rail.

(5) Install the housing in the reverse order of removal. Install the same number of shims as removed from between the housing and rail.

(6) Align the keyway in the yoke with the key in the shaft, and press the yoke into position.

(7) Adjust the backlash between the centershift drive pinion and the rack (subpara c).

(8) Service the housing with lubricant (para 3-28).

c. *Circle Centershift Drive Pinion-to-Rack Backlash Adjustment.* Refer to figure 4-65.

(1) Check the backlash of the pinion with the rack centered, run full right and run full left. Backlash should be 0.010 to 0.030 inch.

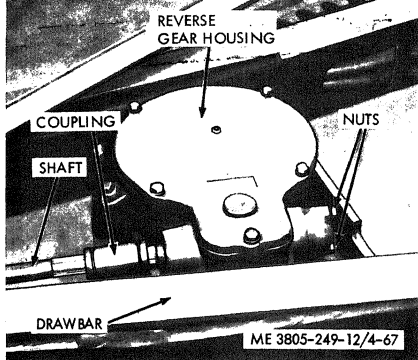


Figure 4-65. Checking pinion backlash.

(2) Add or remove shims between the housing and the rail to obtain backlash within the specified limits.

Note. The backlash will change by approximately one-half the thickness of the shims added or removed.

d. Changing Circle Centershift Control Housing Oil

(1) Remove the drain plug (fig. 4-64) and allow the oil to drain. Clean and install the plug.

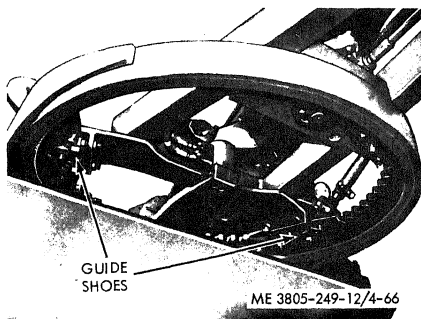
(2) Fill to the bottom of the filler opening. Refer to the Lubrication Order LO 5-3805-249-12 for the correct lubricant. Housing capacity is one quart. Clean and install filler plug.

4-70. Circle Reverse Gear Housing

a. Removal.

(1) Lower the blade to the ground.

(2) Remove the two rear guide shoes (fig. 4-66) and shims. Retain the shims.



housing.

(4) Remove the retainer ring and pin which secure the coupling to the shaft. Refer to figure 4-67.

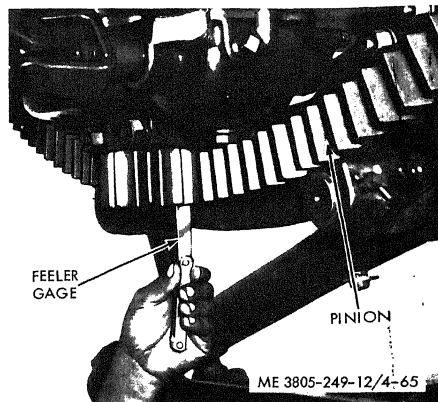


Figure 4-67. Circle reverse gear housing.

(5) Remove the two rings and pins which secure the front end of the shaft to the transfer gear housing.

(6) Slide both couplings onto the shaft, and remove the shaft.

(7) Remove the nuts securing the housing to the circle drawbar, and remove the housing.

b. Installation. Install the housing in the reverse order of removal. Tighten nuts securely.

c. Changing Oil.

(1) Remove the filler plug and the drain plug and allow the oil to drain. Clean and reinstall the drain plug.

(2) Fill to the bottom of the filler opening. Housing capacity is 1½ quarts. Refer to the Lubrication Order LO 5-3805-249-12 for the correct lubricant. Clean and install filler plug.

4-71. Transfer Gear Housing

a. Removal. Refer to figure 4-68.

(1) Remove the drain plug and allow the housing to drain.

(2) Remove the retaining rings, and drive out the pins at both ends of the shaft.

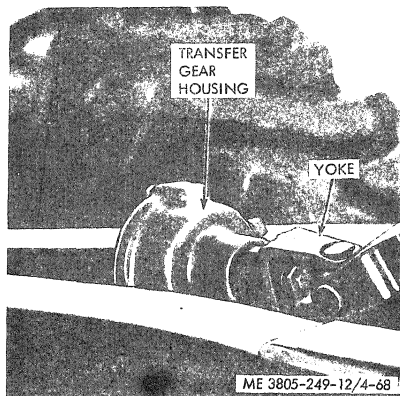


Figure 4-68. Transfer gear housing.

(3) Slide the coupling onto the shaft and remove the shaft.

(4) Remove the nut and lockwasher which secure the housing yoke.

(5) Support the housing and remove four bolts and lockwasher which secure the housing to the frame. Remove the transfer gear housing.

b. Installation.

(1) Install the transfer gear housing in the reverse order of removal. Tighten bolts securely.

(2) Service the housing (para 3-26).

(3) Start the engine and operate the blade through several complete cycles.

(4) Shut down the engine.

4-72. Bevel Pinion Case Replacement

a. Remove the lockrings and pins and slide the coupling onto the shaft. Refer to figure 4-69.

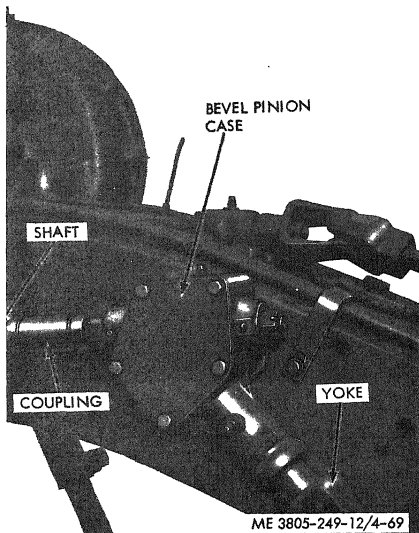


Figure 4-69. Bevel pinion case.

b. Remove the nut and lockwasher which secure the case to the yoke. Remove from the grader.

c. Install the case in the reverse order of removal.

4-73. Drive Shafts and Universal Joints

Note. The leaning wheel, circle reverse, circle centershift and scarifier controls have drive shafts and universal joints which are similar. The drive shaft and universal joints for the transfer gear housing are illustrated here.

a. *Removal.* Refer to figure 4-70.

(1) Support the drive shaft and remove the

nut and lockwasher which secure each yoke to the control shafts.

(2) Remove the drive shaft and universal joints as an assembly.

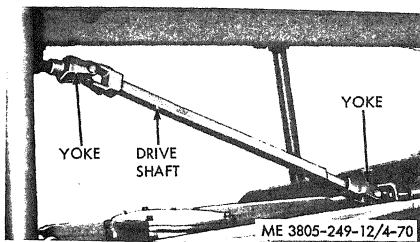


Figure 4-70. Drive shaft and universal joints removal.

b. Disassembly. Refer to figure 4-71.

(1) Remove the retaining rings and bearing cups from each end of the bearing spider.

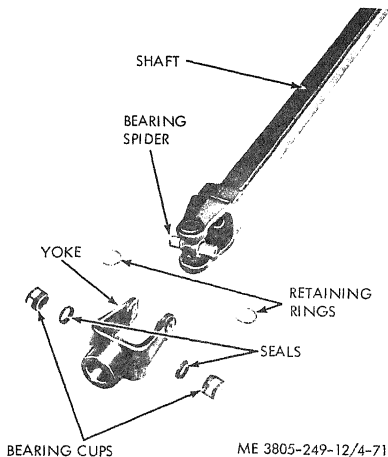


Figure 4-71. Universal joint disassembly.

(2) Remove the spider and seal and separate the shaft from the yoke.

c. Repair.

(1) Inspect the bearing journal surfaces on the bearing spider for roughness or needle bearing grooves.

(2) Inspect each bearing cup for wear and for broken or missing needles.

(3) Pack the bearings with ball and roller bearing lubricant.

(4) If either the bearing spider or bearings are damaged or worn, replace both as a unit.

d. Reassembly. Assemble the universal joint in the reverse order of disassembly.

e. Installation.

(1) Ensure that the yokes at each end of the shaft are parallel.

(2) Install the shaft. Align the slot in the yoke with the key in the shaft and press the yoke into place by tightening the nut.

4-74. Power Control Drive Shaft

a. Removal. Refer to figure 4-72.

(1) At each end of the drive shaft, remove two locks and four bolts securing the universal joint to the flange.

(2) Remove the drive shaft from the grader.

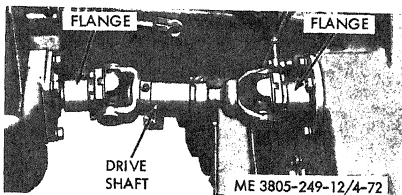
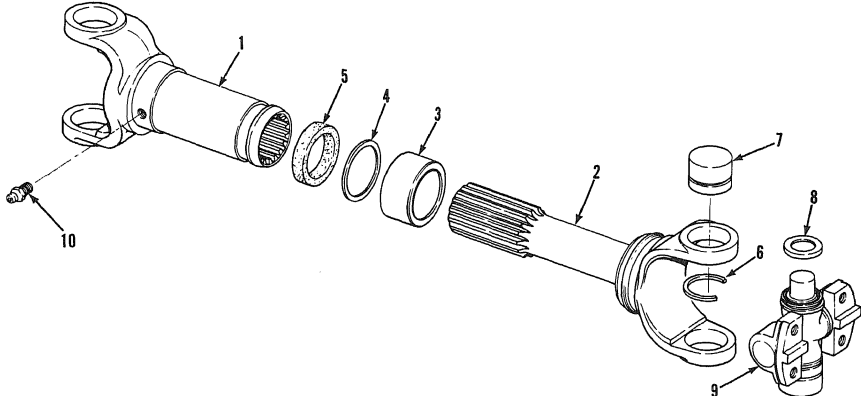


Figure 4-72. Power control drive shaft.

b. Disassembly. Refer to figure 4-73.

(1) Separate the front shaft (1) from the rear shaft (2).

(2) Remove the retainer (3), washer (4) and cork washer (5).



ME 3805-249-12/4-73

1. Front shaft
2. Rear shaft
3. Retainer
4. Washer
5. Cork washer

6. Retaining ring
7. Bearing cup
8. Washer
9. Spider
10. Grease fitting

Figure 4-73. Power control drive shaft, exploded view.

(3) Remove the retaining rings (6), bearing cups (7) and washers (8).

(4) Remove the spider (9) from each yoke.

(5) Remove the grease fitting (10) from the front shaft.

c. Repair.

(1) Inspect the bearing cups for worn, broken or missing needle bearings.

(2) Inspect the bearing journal surfaces of the spider for roughness or grooves.

(3) Replace the spider and bearing cup if either is worn or damaged.

d. Reassembly. Pack the bearings with ball and roller bearing lubricant. Assemble the shaft in the reverse order of disassembly, ensure that the shafts are perfectly aligned before splining.

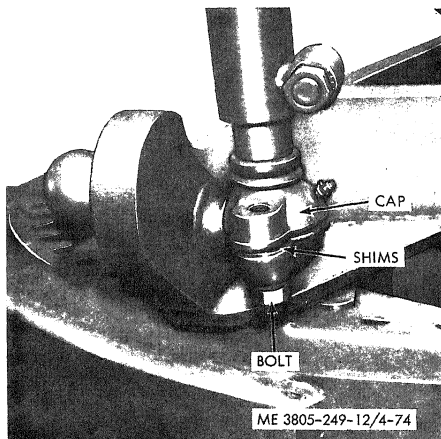
e. Installation. Install the drive shaft in the reverse order of removal. Tighten the bolts to a torque of 13 to 23 ft lbs and secure the locks.

4-75. Ball and Socket Joint Adjustment

a. General. The links for the blade lift, blade centershift and scarifier lift have ball and socket joints which are adjustable by shims.

b. Adjustment. Refer to figure 4-74.

(1) With no load on the link, remove the ball socket cap and shims.



ME 3805-249-12/4-74

Figure 4-74. Ball and socket joint.

(3) Measure the gap between the socket halves. Remove the cap.

(4) Install the cap with shims equal to the gap, plus one additional shim.

4-76. Changing Power Control Housing Oil

a. Remove the filler plug and the drain plug (fig. 4-75) and allow the oil to drain. Clean and install the drain plug.

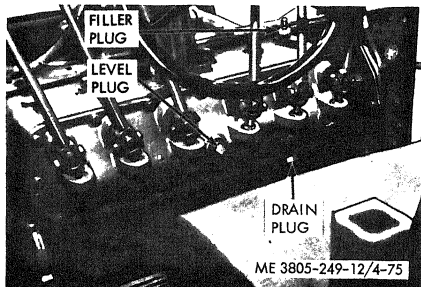


Figure 4-75. Power control housing.

b. Remove the level plug.

c. Add oil until the level reaches the bottom of the level plug opening. Housing capacity is 2 gallons. Refer to the Lubrication Order LO 5-3805-249-12 for the correct lubricant. Clean and install plug.

4-77. Changing Power Control Worm and Gear Housing Oil

a. Remove the drain plug (fig. 4-76) below the operator's compartment and allow the oil to drain. Clean and install the plug.

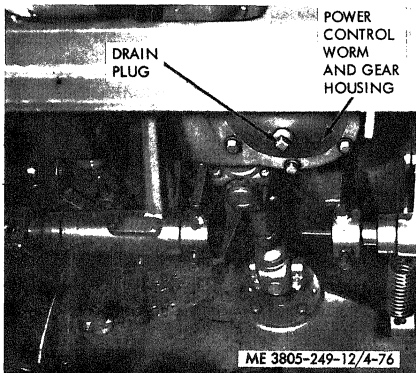


Figure 4-76. Power control worm and gear.

the clutch pedal. Add oil until oil is visible in the filler opening. Housing capacity is 1/2 gallon. Refer to the Lubrication Order LO 5-3805-249-12 for the correct lubricant.

4-78. Blade Circle Adjustment

a. Circle Adjustment. Refer to figure 4-77.

(1) Center and level the blade three or four inches off the ground. Check the clearance between each wear plate and the top of the circle.

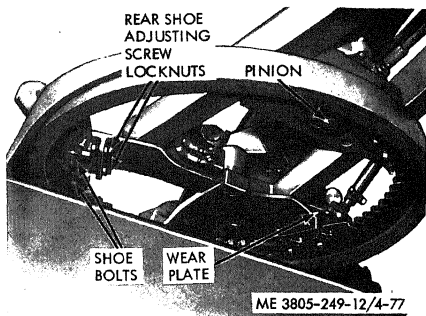


Figure 4-77. Circle adjustment.

(2) Clearance should be 0.010 to 0.062 inch. Rotate the blade through a complete cycle, checking the clearance at each 90 degrees of rotation.

(3) Remove the shoe bolts and remove or add shims to adjust the clearance. Replace the shoes if proper adjustment cannot be obtained.

(4) Install the bolts and again check the clearance.

(5) Lower the blade to the ground and inch the machine forward to put a light load on the front shoes.

(6) Measure the distance between the OD of the pinion and the machined ID of the circle. Distance should be 1.90 to 1.92 inches.

(7) If the distance is less than 1.90 inches, replace the front shoes and perform (1) through (4).

(8) Loosen the locknut on the rear shoe adjusting screws.

(9) Turn the adjusting screws to move the toe of each rear shoe against the circle. If the shoes will not contact the circle, replace the shoes and perform (1) through (4). Back off the adjusting screws 1/3 turn and tighten locknuts.

(10) Check the clearance between the rear shoes and the ID of the circle. With a light load on the front shoes, clearance should be 0.030 to 0.090 inch. If necessary, adjust the shoes with the ad-

(11) Rotate the circle a complete revolution and check for free movement.

b. Circle Drawbar Ball and Socket Adjustment. Refer to figure 4-78.

Note. The ball and socket joint at the front of the circle drawbar is equipped with shims which can be removed to compensate for looseness caused by wear.

- (1) Raise the blade off the ground.
- (2) Pry the drawbar as far back as possible
- (3) Measure the clearance between the drawbar ball and cap. Clearance should not exceed 0.062 inch.

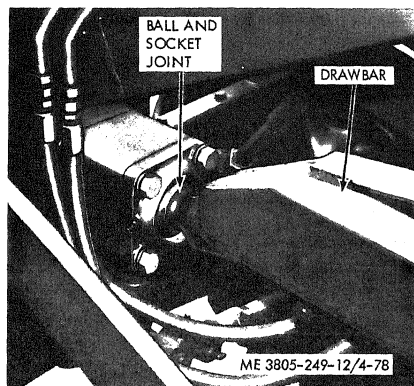


Figure 4-78. Drawbar ball and socket joint.

(4) Remove shims as necessary to obtain the proper clearance.

4-79. Blade Assembly

a. Removal. Refer to figure 4-79.

(1) Lower the blade to the ground and block in position.

(2) At the right side of the blade, remove notched block and nut which secure the blade to the circle assembly.

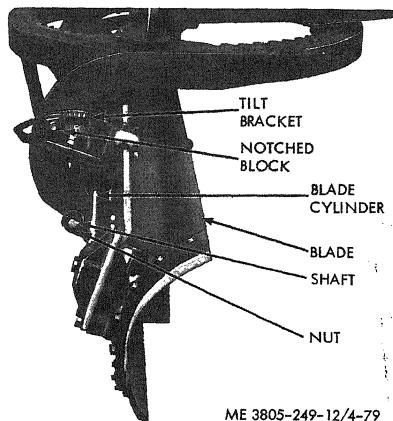


Figure 4-79. Blade assembly.

(3) Move the right tilt bracket to the right until it clears the end of the shaft.

(4) At the left side of the blade, remove notched block and hardware.

(5) Attach a hoist to support the blade assembly.

(6) Start the engine and sideshift the hydraulic cylinder until the lift tilt bracket clears the left arm of the shaft.

(7) Disconnect the lines to the blade cylinder. Cap or plug openings.

Caution: Do not move the blade sideshift control lever from the **HOLD** position while the cylinder lines are disconnected.

(8) Lower the blade assembly to the face down position.

(9) Engage the blade lift controls and raise the circle assembly to clear the blade. Remove the blade from beneath the machine.

b. Installation. Install the blade by reversing

the removal procedure. Check the hydraulic oil level and add as necessary. Start the engine and operate the blade sideshift through several complete cycles. Shut down the engine and check for hydraulic oil leaks.

c. Cutting Edge Replacement.

(1) Remove 26 bolts securing the cutting edge to the moldboard.

(2) Loosen the five bolts which secure each end bit to the moldboard.

(3) Remove the cutting edge and install a new cutting edge. Secure with new bolts if necessary. Tighten all bolts securely.

d. End Bits Replacement.

(1) Remove five bolts which secure each end bit to the moldboard and remove the end bits.

(2) If only one edge of the end bits has been used, reverse and install on opposite ends of the moldboard. If both edges have been used, install new end bits. Tighten bolts securely.

4-80. Scarifier Assembly

a. Control Housing Replacement. Refer to figure 4-80.

(1) Disconnect the lift links from the control assembly by removing two bolts and lockwashers and the cap at each ball joint.

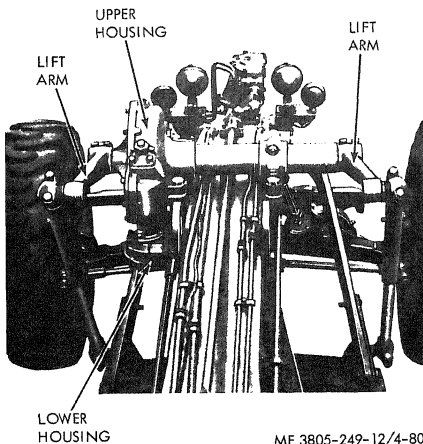


Figure 4-80. Scarifier control housing.

(2) Attach a hoist to support the housing.

(3) Disconnect the shaft to the lower control housing.

(6) Install the housing in the reverse order of removal.

(7) To determine the number of shims to install in the lift link ball and socket joints, refer to paragraph 4-75.

b. Frame and Drawbar Replacement. Refer to figure 4-81.

(1) Lower the scarifier to the ground and block in position.

(2) Disconnect the lift links from the scarifier by removing two bolts and lockwashers and the cap at each ball joint.

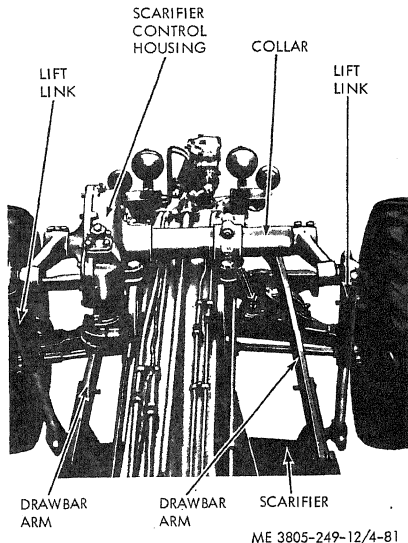


Figure 4-81. Scarifier assembly.

(3) Attach a suitable hoist to support the scarifier.

(4) Remove the bolt, lockwasher and nut and remove the collar at both drawbar arms.

c. Changing Scarifier Control Housing Oil

(1) Upper housing. Refer to figure 4-82.

(a) Remove the filler plug and the drain plug and allow the oil to drain. Clean and reinstall the drain plug.

(b) Remove the level plug and fill to the bottom of the level plug opening. Refer to the

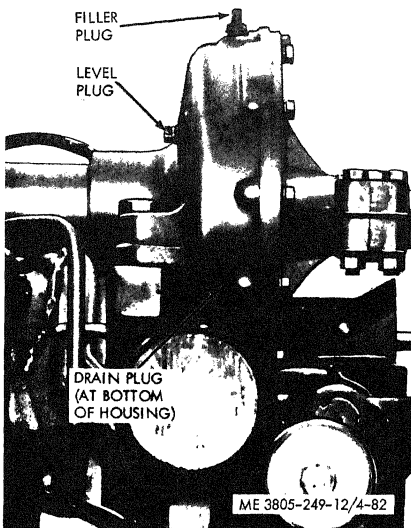


Figure 4-82. Scarifier control upper housing.

(2) Lower housing. Refer to figure 4-83.

(a) Remove the filler plug and drain plug and allow the oil to drain. Clean and reinstall the drain plug.

(b) Fill to the bottom of the filler plug opening. Refer to the Lubrication Order LO 5-3805-249-12 for the correct lubricant. Housing

capacity is 1 quart. Clean and reinstall the filler plug.

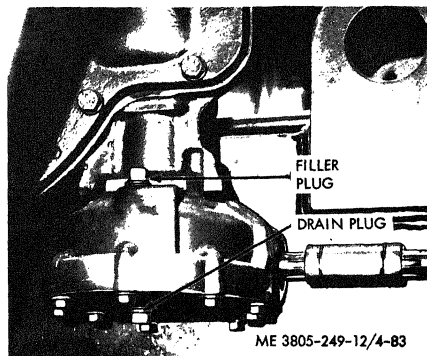


Figure 4-83. Scarifier control lower housing.

(3) Remove the bolts and nuts which secure the left drawbar arm to the scarifier. Remove the left drawbar arm.

(4) Swing the scarifier to the right as far as the lift chains will allow.

(5) Lift the scarifier with the right drawbar arm attached and remove from the grader.

(6) Install the scarifier in the reverse order of removal.

(7) To determine the number of shims to install in the lift link ball and socket joints, refer to paragraph 4-75.

**CHAPTER 5. ADMINISTRATIVE
STORAGE AND INSTRUCTIONS FOR
DESTRUCTION OF MATERIEL TO
PREVENT ENEMY USE**

Section I. ADMINISTRATIVE STORAGE

Refer to TM 740-90-1.

Section II. DESTRUCTION OF MATERIEL TO PREVENT ENEMY USE

Refer to TM 750-244-13.

APPENDIX A

REFERENCES

A-1. Fire Protection

TB 5-4200-200-10

A-2. Lubrication

C9100-IL

LO 5-3805-249-12

A-3. Painting

TM 9-213

A-4. Radio Suppression

TM 11-483

A-5. Maintenance

TM 9-1870-1

TB 750-651

TM 38-750

TM 9-6140-200-15

A-6. Shipment and Storage

TB 740-93-2

TM 740-90-1

A-7. Destruction to prevent enemy use

TM 750-244-3

Hand Portable Fire Extinguishers for Army Use

Identification List for Fuels, Lubricants, Oil and Waxes

Lubrication Order, Grader, Road, Motorized DED, Type I, 12 Ft Blade, Caterpillar Model 120

Painting Instructions for Field Use

Radio Interference Suppression

Care and Maintenance of Pneumatic Tires

Use of Antifreeze Solutions and Cleaning Compounds in Engine Cooling Systems.

The Army Maintenance Management Systems

Operation and Organizational, Field and Depot Maintenance: Storage Batteries, Lead Acid Type

Preservation of USAMEC Mechanical Equipment for Shipment and Storage

Administrative Storage of Equipment

Procedures for Destruction of Equipment to Prevent Enemy Use

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. General

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

b. Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance functions.

c. Section III lists the special tools and test equipment required for each maintenance function as referenced from Section II.

d. Section IV contains supplemental instructions, explanatory notes and/or illustrations required for a particular maintenance function.

B-2. Explanation of Columns in Section II

a. *Group Number, Column (1).* The assembly group is a numerical group assigned to each assembly in a top down breakdown sequence. The applicable assembly groups are listed on the MAC in disassembly sequence beginning with the first assembly removed in a top down disassembly sequence.

b. *Functional Group, Column (2).* This column contains a brief description of the components of each assembly group.

c. *Maintenance Functions, Column (3).* This column lists the various maintenance functions (A through K) and indicates the lowest maintenance category authorized to perform these functions. The symbol designations for the various maintenance categories are as follows:

- C — Operator or crew
- O — Organizational maintenance
- F — Direct support maintenance
- H — General support maintenance
- D — Depot maintenance

The maintenance functions are defined as follows:

- A — Inspect. To determine serviceability of an item by comparing its physical, mechanical, and electrical characteristics with established standards.
- B — Test. To verify serviceability and to detect

electrical or mechanical failure by use of test equipment.

- C — Service. To clean, to preserve, to charge, and to add fuel, lubricants, cooling agents, and air. If it is desired that elements, such as painting and lubricating, be defined separately, they may be so listed.
- D — Adjust. To rectify to the extent necessary to bring into proper operating range.
- E — Align. To adjust specified variable elements of an item to bring to optimum performance.
- F — Calibrate. To determine the corrections to be made in the readings of instruments or test equipment used in precise measurement. Consists of the comparison of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared with the certified standard.
- G — Install. To set up for use in an operational environment such as an emplacement, site, or vehicle.
- H — Replace. To replace unserviceable items with serviceable like items.
- I — Repair. Those maintenance operations necessary to restore an item to serviceable condition through correction of material damage or a specific failure. Repair may be accomplished at each category of maintenance.
- J — Overhaul. Normally, the highest degree of maintenance performed by the Army in order to minimize time work in process is consistent with quality and economy of operation. It consists of that maintenance necessary to restore an item to completely serviceable condition as prescribed by maintenance standards in technical publications for each item of equipment. Overhaul normally does not return an item to like new, zero mileage, or zero hour condition.

K — Rebuild. The highest degree of materiel maintenance. It consists of restoring equipment as nearly as possible to new condition in accordance with original manufacturing standards. Rebuild is performed only when required by operational considerations or other paramount factors and then only at the depot maintenance category. Rebuild reduces to zero the hours or miles the equipment, or component thereof, has been in use.

d. Tools and Equipment, Column (4). This column is provided for referencing by code the special tools and test equipment, (sec. III) required to perform the maintenance functions (sec. II).

e. Remarks, Column (5). This column is provided for referencing by code the remarks (sec. IV) pertinent to the maintenance functions.

B-3 Explanation of Columns in Section III

a. Reference Code. This column consists of a number and a letter separated by a dash. The

number references the T&TE requirements column on the MAC. The letter represents the specific maintenance function the item is to be used with. The letter is representative of columns A through K on the MAC.

b. Maintenance Category. This column shows the lowest level of Maintenance authorized to use the special tool or test equipment.

c. Nomenclature. This column lists the name or identification of the tool or test equipment.

d. Tool Number. This column lists the manufacturer's code and part number, or Federal Stock Number of tools and test equipment.

B-4. Explanation of Columns in Section IV

a. Reference Code. This column consists of two letters separated by a dash, both of which are references to Section II. The first letter references column (5) and the second letter references a maintenance function, column (3), A through K.

b. Remarks. This column lists information pertinent to the maintenance function being performed, as indicated on the MAC, Section II.

(1) Group No.	(2) Functional group	(3) Maintenance functions											(4) Tools and equipment	(5) Remarks
		A	B	C	D	E	F	G	H	I	J	K		
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild		
01	ENGINE													
0100	Engine Assembly:													
	Engine	C	F	C					F	F	D			A-B
0101	Crankcase, Block, Cylinder Head:													
	Head Cylinder								F	H				
0102	Crankshaft:													
	Pulley								F	F				
0103	Flywheel Assembly:													
	Flywheel Housing, Ring Gear								F	F				B-I
0104	Pistons, Connecting Rods, Bearings,													
	Pins, Rings	H	H			H			H	H				
0105	Valves, Camshafts, and Timing System:													
	Arm, Rocker				O				F	F				
	Valves, Seats								H	H				
	Timing Gears								D					
0106	Engine Lubricating System:													
	Breather			C					O					
	Pump, Oil								H	H				
	Filter, Oil			O					O					
	Cooler, Oil	O							F					
0108	Manifolds													
	Intake & Exhaust	O							F					
0109	Accessory Driving Mechanism													
	Gears								H	H				
	Bearings								H	H				
	Retainers								H					
02	CLUTCH													
0200	Clutch Assembly:													
	Clutch Assembly			O										
	Disks, Plates								F					
0202	Clutch Release Mechanism:													
	Bearings, Shaft, Yoke			O					F					
	Pedal, Linkage				O				O					
0206	Clutch, Brake:													
	Hub, Plate			F					F					
03	FUEL SYSTEM													
0301	Fuel Injector:													
	Injector, Fuel		F		F				F	H				
0302	Fuel Pumps:													
	Pump, fuel transfer	O	O						O	F				
	Pump, fuel		O						O	F				
0304	Air Cleaner:													
	Cleaner, Air, Cartridge			C					O					
0305	Blower:								F	H				
0306	Tanks, Lines, Fittings:								O	O				
	Cap, Fittings, Lines								O	F				
	Tank	C		C					O					
0308	Engine Speed Governor and Controls:													
	Governor				F				F	D				
0309	Fuel Filters:													
	Filter, Fuel			O					O					
0311	Starting Aid:			C					O	O				
04	EXHAUST SYSTEM													
0401	Muffler								O					
	Exhaust Pipe								O					
	Brackets & Clamps								O					
	Aspirator								O					

Section II. MAINTENANCE ALLOCATION CHART

(1) Group No.	(2) Functional group	(3) Maintenance functions											(4) Tools and equipment	(5) Remarks
		A	B	C	D	E	F	G	H	I	J	K		
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild		
05	COOLING SYSTEM													
0501	Radiator:													
	Core, Tanks								F	F				
	Radiator	C		C					O	F				
0503	Water Manifold, Headers, Thermostat & Housing Gasket													D-I
	Thermostat	C							O					
	Hoses	C							O					
	Gaskets	C							O					
0504	Water Pump:													
	Pump, Water								O	F				
0505	Fan Assembly:													
	Belt, vee	C			O				O					
06	ELECTRICAL SYSTEM													
0600	Alternator:													
	Belt, vee	C			C				C					
	Alternator		O	O					O	F				C-I
0603	Starting Motor:													
	Starter		O						O	F				
0607	Instrument or Engine Control Panel:													
	Wiring	O								F				
	Lights	O							O					
	Gauges	O							O					
0608	Miscellaneous Items:													
	Circuit Breaker			O					O					
	Switches			O					O					
	Fuses			O					O					
0609	Lights:													
	Head	C							O					
	Tail	C							O					
	Marker	C							O					
0611	Horn:													
	Wiring								O	O				
0612	Batteries:													
	Batteries		O	C					C					
	Cables								C					
0613	Chassis Wiring Harness:													
	Harness, Wiring								F	O				
0615	Radio Interference Suppression:													
	Components		O						O					
07	TRANSMISSION													
0701	Transmission Assembly, Hydraulic:			O							H	D		
	Bearings										H			
	Gears										H			
	Planetary Units										H			
	Gaskets										H			
	Seals	O								F	H			
	Covers	O								F				
0713	Torqmatic Brake													
	Discs										H			
	Plates										H			

(1) Group No.	(2) Functional group	(3) Maintenance functions											(4) Tools and equipment	(5) Remarks
		A	B	C	D	E	F	G	H	I	J	K		
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild		
0721	Coolers & Pumps Pump Filter Pressure Regulator Breather Pipes, Fittings .....	..	..	O	..	..	..	..	H O H O	H H O	H			
08	TRANSFER & FINAL DRIVE ASSEMBLY													
0801	Transfer Gear: Bearings Gaskets .....	..	..	..	..	..	..	..	H H H					
09	PROPELLER AND PROPELLER SHAFTS													
0900	Propeller Shafts: Shaft, Clutch Drive Shaft, Power Control Box Drive .....	..	..	..	..	..	..	..	F O	F O				
10	FRONT AXLE													
1000	Front Axle Assembly: Axle Assembly, Front .....	..	..	O	..	..	..	..	F	F				
1004	Steering and Leaning Wheel Mechanism: Gear Box Assembly Knuckles, Arms, Shafts, Bearings, Seals, Flanges, Pins, Gear Case, Gears Shafts, Bushings Shafts, Control Joints, Universal	C	..	O	..	..	..	..	O F C	F F				
11	REAR AXLE													
1103	Final Drive: Final Drive Assembly .....	..	..	O	..	..	..	..	H	H				
1105	Tandem Drive Assembly: Carrier Axle Assembly Chain, Drive .....	..	..	O	..	..	..	..	H F	H F				
1108	Walking Beams, Stud Axles and Parts: Axle, Drive Assembly .....	..	..	O	..	..	..	..	H	H				
12	BRAKES													
1201	Hand Brakes: Drum Levers, Linkage Shoe Assembly .....	..	..	..	C	..	..	..	O O O	F F				
1202	Service Brakes: Brakes, Service Shoe Assembly .....	..	..	..	O	..	..	..	F F	F F				
1204	Hydraulic Brake System: Cylinder, Master Cylinder, Wheel	C	..	O	..	..	..	..	O F	F F				
1206	Mechanical Brake Controls: Pedal, Brackets, Linkage, Rods .....	..	..	..	O	..	..	..	O					
13	WHEELS													
1311	Wheel Assembly: Bearings, Seals (front) Drums .....	..	..	O	..	O	..	..	O F	F				

(1) Group No.	(2) Functional group	(3) Maintenance functions											(4) Tools and equipment	(5) Remarks
		A	B	C	D	E	F	G	H	I	J	K		
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild		
1313	Tires:													
	Tires .....	..	..	C	..	..	..	..	O	O				
14	STEERING													
1401	Steering Assembly:													
	Shafts, Draglinks, Arm .....	..	..	C	..	..	..	..	O	O				
	Steering Gear Assembly .....	..	..	O	..	..	..	..	F	F				
1410	Hydraulic Pump:													
	Pump, Hydraulic .....	..	O	..	..	..	..	..	O	F				
1414	Steering System Valves:													
	Valve Assemblies .....	..	..	..	..	..	..	..	O	F				
15	FRAME, TOWING ATTACHMENTS													
1501	Frame Assembly													
	Guards, Brackets, Hangers	O	..	..	..	..	..	..	O	O				
1503	Pintles and Towing Attachments:													
	Ring, Tow, Front	C	..	..	..	..	..	..	O	F				
	Pintle Tow, Rear	C	..	C	..	..	..	..	O					
18	BODY, CAB, HOOD													
1801	Hood .....	..	..	..	..	..	..	..	O					
	Engine Panels .....	..	..	..	..	..	..	..	O					
1805	Floors:													
	Floor, Sheet .....	..	..	..	..	..	..	..	O					
1806	Seats:													
	Seat & Rests	O	..	..	..	..	..	..	O					
20	POWER CONTROL UNIT													
2002	Power Control Unit Assembly:													
	Brake Band .....	..	..	..	C	..	..	..	O					
	Control Assembly	C	..	O	..	..	..	..	F	F				
	Shaft, Propeller .....	..	..	C	..	..	..	..	O	O				
43	HYDRAULIC SYSTEM													
4301	Filters, Hoses, Fittings, Tubing:	O	..	..	..	..	..	..	O					
	Filter, Hydraulic Oil .....	..	..	O	..	..	..	..	O					
	Junction Assembly .....	..	..	C	..	..	..	..	O					
4302	Pump and Pump Drives .....	..	..	O	..	..	..	..	O	F				
4305	Control Valves:													
	Valves	O	..	..	..	..	..	..	O	F				
4307	Hydraulic Cylinders:													
	Cylinder, Hydraulic .....	..	..	..	..	..	..	..	F	F				
4308	Liquid Tank or Reservoirs													
	Hydraulic Reservoir	O	..	O	..	..	..	..		
47	GAUGES & MEASURING DEVICES													
4701	Speedometer-odometer	O	..	..	..	..	..	..	O	F				
	Drive Cable & Adapters	O	..	..	..	..	..	..	O					
4703	Hourmeter:													
	Meter "Component of Fuel Transfer Pump"	O	..	..	..	..	..	..	O	F				
74	EARTH MOVING EQUIP.													
7435	COMPONENTS													
	Moldboard Assembly: .....	..	..	..	..	..	..	..	..	..	..	..	..	..E-I
	Blade Assembly	C	..	..	..	..	..	O	F					
	Moldboard Assembly .....	..	..	..	C	..	..	..	O	F				

Section II. MAINTENANCE ALLOCATION CHART

(1) Group No.	(2) Functional group	(3) Maintenance functions											(4) Tools and equipment	(5) Remarks
		A	B	C	D	E	F	G	H	I	J	K		
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild		
7436	Lift Arms and Pivot Assemblies: Bar, Links, Arms	C	C	O	1-H	..F-I
7438	Circle and Drawbar Assembly: Circle, Drawbar .....	..	..	C	O	..	..	..	F	F	..	..
7439	Circle Reverse Drawbar Shift & Lift Mechanism: Gear Box Assembly .....	..	..	O	C	..	..	..	O	F	O	..
7440	Joints, Universal .....	..	..	..	..	..	..	..	O	O	..	..
7441	Scarifier Assembly: Drawbar, Rods, Bushings, Angle Adjustments .....	..	..	..	C	..	..	..	O	..	..	..
7441	Shanks, Teeth .....	..	..	..	C	..	..	..	C	..	..	..
7441	Scarifier Actuating: Gear Box Assembly .....	..	..	O	O	..	..	..	O	F	O	..
7441	Joints, Universal .....	..	..	..	..	..	..	..	O	O	..	..
7441	Shafts, Arms, Bushings .....	..	..	C	..	..	..	..	O	..	..	..
76	FIRE FIGHTING EQUIPMENT													
7603	Fire Extinguishers: Extinguishers, Fire .....	..	..	C	..	..	..	..	C	..	..	..

Section III. SPECIAL TOOL AND SPECIAL TEST EQUIPMENT

Reference code	Maintenance level	Nomenclature	Tool Number
1-H	C	Remove, Scarifier point	

Section IV. EXPLANATORY NOTES AND SUPPLEMENTAL INSTRUCTIONS

Reference code	Remarks
A—B	Test includes operation and compression.
B—I	Repair of flywheel includes replacing ring gear.
C—I	Repair of generator includes replacement of brushes only.
D—I	Repair of starter includes replacement of brushes and solenoid assembly only.
E—I	Repair of blade includes replacing bits and cutting edge only.
F—I	Repair of scarifier includes replacing teeth only.

APPENDIX C

BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

C-1. Scope

This appendix lists items which accompany the Model 120 Road Grader or are required for installation, operation, or operator's maintenance.

C-2. General

This Basic Issue Items List is divided into the following sections:

a. *Basic Issue Items*—Section II. A list of items which accompany the Model 120 Road Grader and are required by the crew / operator for installation, operation, or maintenance.

b. *Maintenance and Operating Supplies*—Section III. A listing of maintenance and operating supplies required for initial operation.

C-3. Explanation of Columns

The following provides an explanation of columns in the tabular list of Basic Issue Items, Section II.

a. *Source, Maintenance, and Recoverability Codes (SMR)*:

(1) Source code indicates the source for the listed item. Source codes are:

Code	Explanation
P	Repair parts, Special Tools and Test Equipment supplied from the GSA / DSA, or Army supply system and authorized for use at indicated maintenance categories.
P2	Repair parts, Special Tools and Test Equipment which are procured and stocked for insurance purposes because the combat or military essentiality of the end item dictates that a minimum quantity be available in the supply system.
M	Repair parts, Special Tools and Test Equipment which are not procured or stocked, as such, in the Supply System but are to be manufactured at indicated maintenance levels.
A	Assemblies which are not procured or stocked as such, but are made up of two or more units. Such component units carry individual stock numbers and descriptions, are procured and stocked separately and can be assembled to form the required assembly at indicated maintenance categories.
X	Parts and assemblies that are not procured or stocked, but which, with failure rate, is normally

Code	Explanation
X2	Repair parts, Special Tools and Test Equipment which are not stocked and have no foreseen mortality. The indicated maintenance category requiring such repair parts will attempt to obtain the parts through cannibalization or salvage, the item may be requisitioned with exception data, from the end item manager, for immediate use.
G	Major assemblies that are procured with PEMA funds for initial issue only as exchange assemblies at DSU and GSU level. These assemblies will not be stocked above DS and GS level or returned to depot supply level.

(2) Maintenance code indicates the lowest category of maintenance authorized to install the listed item. The maintenance level code is:

Code	Explanation
C	Crew / Operator
(3)	Recoverability code indicates whether unserviceable items should be returned for recovery or salvage. Items not coded are nonrecoverable. Recoverability codes are:

Code	Explanation
R	Applied to repair parts, (assemblies and components) special tools and test equipment which are considered economically repairable at direct and general support maintenance levels. When the item is no longer economically repairable, it is normally disposed of at the GS level. When supply considerations dictate, some of these repair parts may be listed for automatic return to supply for depot level repair as set forth in AR 710-50. When so listed, they will be replaced by supply on an exchange basis.
S	Repair parts, special tools, test equipment and assemblies which are economically repairable at DSU and GSU activities and which normally are furnished by supply on an exchange basis. When items are determined by a GSU to be uneconomically repairable, they will be evacuated to a depot for evaluation and analysis before final disposition.
T	High dollar value recoverable repair parts, special tools and test equipment which are subject to special handling and are issued on an exchange basis. Such items will be repaired or overhauled

b. Federal Stock Number. This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. This column indicates the Federal item name and any additional description of the item required. The abbreviation "w/e", when used as a part of the nomenclature, indicates the Federal stock number, includes all armament, equipment, accessories, and repair parts issued with the item. A part number or other reference number is followed by the applicable five-digit Federal supply code for manufacturers in parenthesis. Repair parts quantities included in kits, sets, and assemblies are shown in front of the repair part name.

d. Unit of Measure (U/M). A two-character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowances are based, e.g., ft, ea, pr, etc.

e. Quantity Incorporated in Unit. This column indicates the quantity of the item used in the assembly group. A "V" appearing in this column in lieu of a quantity indicates that a definite quantity cannot be indicated (e.g. shims, spacers, etc.)

f. Quantity Furnished With Equipment. This column indicates the quantity of an item furnished with the equipment.

g. Illustration. This column is divided as follows:

(1) *Figure number.* Indicates the figure number of the illustration in which the item is shown.

(2) *Item number.* Indicates the callout number used to reference the item in the illustration.

C-4. Explanation of Columns in the Tabular List of Maintenance and Operating Supplies—Section III.

a. Component Application. This column identifies the component application of each maintenance or operating supply item.

b. Federal Stock Number. This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. This column indicates the item name and brief description.

d. Quantity Required for Initial Operation. This column indicates the quantity of each maintenance or operating supply item required for initial Operation of the equipment.

e. Quantity Required for 8 Hours Operation. This column indicates the estimated quantities required for an average 8 hours of operation.

f. Notes. This column indicates informative notes keyed to data appearing in a preceding column.

Section II. BASIC ISSUE ITEMS

(1) SMR code	(2) Federal stock number	(3) Description Ref no. & MFR code	(4) Unit of meas Usable on code	(5) Qty line in unit	(6) Qty furn with equip	(7) Illustration	
						(A) fig no.	(B) Item no.
PO	7510-889-3494	BINDER: loose-leaf	EA	1	1		
PO	7520-559-9618	CASE: Operation & Maintenance Manuals	EA	1	1		
PO	4210-889-2221	EXTINGUISHER: Fire	EA	1	1		
		ARMY TECHNICAL MANUAL TM 5-3805-249-12	EA	1	1		
		ARMY LUBRICATION ORDER LO 5-3805-249-12	EA	1	1		

Section III. MAINTENANCE AND OPERATING SUPPLIES

(1) Component application	(2) Federal stock number	(3) Description	(4) Quantity required F / Initial operation	(5) Quantity required F / 8 hrs operation	(6) Notes
CRANK CASE	..... 9150-680-1104(2) 9150-680-1105(2) 9150-242-7605(2)	OIL, LUBRICATING; ENGINE 55 gal drum as follows: HDO-30 HDO-10 OES	22 qts 22 qts 22 qts	(3) (3) (3)	(1) Includes quantity of oil to fill system as follows: 20-qts Engine crankcase 2-qts Oil Filter
BLADELIFT CON- TROL	..... 9150-577-5846(2) 9150-257-5443(2)	OIL, LUBRICATING, GEAR: 55 gal drum as follows: GO-90 GOS	2 qts ea 2 qts ea	(3) (3)	(2) See C9100-IL for additional requisitioning procedure. (3) See current LO for grade approp- riate replenishment intervals.
BRAKE MASTER CYLINDER	..... 9150-231-9071(2)	BRAKE FLUID: AUTOMOTIVE 1 gal can as follows: HB GO-90 GOS	1 qt	(3)	(4) Tank Capacity
CIRCLE CENTER SHIFT	.....	OIL, LUBRICATING GEAR: GO-90 GOS	1 qt (6) 1 qt (6)	(3) (3)	(5) Average Fuel consumption 1 hour of continuous operation
CIRCLE REVERSE CONTROL	.....	OIL, LUBRICATING, GEAR GO-90 GOS	1½ qt (6) 1½ qt (6)	(3) (3)	(6) Use oil as prescribed for Blade (7) Use oil as prescribed for En
FUEL TANK	..... 9150-286-5294(2) 9150-286-5286(2) 9150-286-5283(2)	DIESEL FUEL: Bulk as follows DF2 Regular DF 1 Winter DF A Arctic GREASE, AUTOMOTIVE AND AR- TILLARY: 5 lb can as follows: GAA	75 gal (4) 75 gal (4) 75 gal (4)	28 gal (5) 28 gal (5) 28 gal (5)	
GREASE POINTS	..... 9150-190-0905(2)	OIL, LUBRICATING, ENGINE 55 gal drum as follows: OE-10 OES	5 lb	(3)	
HYDRAULIC SYSTEM	..... 9150-265-9430(2) 9150-242-7605(2)	OIL, LUBRICATING, GEAR GO-90 GOS	18 qts 18 qts	(3) (3)	
LEAN WHEEL CONTROL	.....	OIL, LUBRICATING, GEAR GO-90 GOS	1½ qt (6) 1½ qt (6)	(3) (3)	
POWER CONTROL HOUSING	.....	OIL, LUBRICATING, GEAR GO-90 GOS	8 qts (6) 8 qts (6)	(3) (3)	
POWER CONTROL SHAFT AND GEAR HOUSING	.....	OIL, LUBRICATING, GEAR GO-90 GOS	1½ qt (6) 1½ qt (6)	(3) (3)	
REAR AXLE HOUSING	.....	OIL, LUBRICATING, GEAR GO-90 GOS	37 qts 37 qts	(3) (3)	

Section III. MAINTENANCE AND OPERATING SUPPLIES

(1) Component Application	(2) Federal stock number	(3) Description	(4) Quantity required F/initial operation	(5) Quantity required F/8 hrs operation	(6) Notes
FOR	.....	WATER	44 qts		
	6850-644-1409	ANTIFREEZE: 55-gal drum as follows:			
	6850-174-1806	ANTIFREEZE: Ethylene Glycol Compound Arctic	26 qts		
ER UPPER	.....	OIL, LUBRICATING, GEAR	44 qts		
NG	.....	GO-90	6½ qt ea	(3)	
	.....	GOS	6½ qt ea	(3)	
ER LOWER	.....	OIL, LUBRICATING, GEAR	1 qt	(3)	
NG	.....	GO-90	1 qt	(3)	
NG	.....	GOS			
NG	.....	OIL, LUBRICATING, ENGINE	¾ qt (7)	(3)	
NG	.....	HDO-30	¾ qt (7)	(3)	
	.....	HDO-10	¾ qt (7)	(3)	
M	.....	OES			
NG	.....	OIL, LUBRICATING, GEAR	24 qts ea (6)	(3)	
	.....	GO-90	24 qts ea (6)	(3)	
	.....	GOS			
MISSION	.....	OIL, LUBRICATING, ENGINE	80 qts	(3)	
FLYWHEEL	9150-265-9436(2)	OE-30	80 qts	(3)	
CH	9150-265-9430(2)	OE-10	80 qts	(3)	
	9150-242-7605(2)	OES	80 qts	(3)	
ER	.....	OIL, LUBRICATING, GEAR	1 / 3 qt (6)	(3)	
NG	.....	GO-90	1 / 3 qt (6)	(3)	
	.....	GOS			

INDEX

A Paragraph Page

Adjustment:		
Ball and socket joint	4-75	4-40
Blade circle	4-78	4-41
Blade circle drawbar ball and socket	4-78	4-41
Blade lift controls	4-68	4-33
Centershift link	2-3	2-1
Circle centershift controls	4-69	4-36
Fan belts	4-29	4-15
Parking brake	3-20	3-8
Pedal and linkage	4-13	4-5
Scarifier	2-3	2-1
Service brakes	4-50	4-26
Valve lash	4-11	4-4
Administrative storage		5-1
Air cleaner:		
Replacement	4-21	4-11
Service	3-11	3-4
Alternator	4-33	4-16

B

Ball and socket joint adjustment	4-75	4-40
Batteries:		
Extreme cold	2-14	2-17
Extreme heat	2-15	2-17
Replacement	4-35	4-18
Service	3-14	3-6
Bevel pinion case replacement	4-72	4-38
Blade assembly	4-79	4-42
Blade circle adjustment	4-78	4-41
Blade lift control housing:		
Maintenance	4-68	4-33
Service	3-29	3-11
Blade sideshift control valve	4-63	4-31
Brake master cylinder	3-21, 4-51	3-9, 4-27
Brake pedal and linkage	4-52	4-27
Breather service	3-9	3-3

C

Changing oil:		
Axle housing	4-40	4-21
Engine	4-10	4-3
Power control housing	4-76	4-41
Power control worm and gear housing	4-77	4-41
Tandem drive housing	4-41	4-21
Circle centershift control housing:		
Maintenance	4-69	4-36
Service	3-28	3-10
Circle reverse gear housing:		
Maintenance	4-70	4-37
Service	3-27	3-10
Circle transfer gear housing:		
Removal	4-71	4-37
Service	3-26	3-10
Controls and instruments	2-9	2-4
Cooling system:		
Engine	2-14	2-17

D Paragraph Page

Description	1-5	1-1
Destruction of material to prevent enemy use	5-1	5-1
Detailed lubrication instructions	3-3	3-1
Difference between models	1-6	1-3
Drive shafts and universal joints	4-73	4-38
Driving to a new site	2-5	2-3

E

Engine side panels	4-57	4-29
Equipment conversion	2-3	2-1
Equipment serviceability criteria	1-3	1-1
Exhaust manifold	4-22	4-12
Exhaust pipe and muffler	4-23	4-12
Exterior lights	4-36	4-18

F

Fan	4-28	4-14
Fan belts:		
Inspection	3-13	3-6
Replacement	4-29	4-15
Fire extinguisher	2-20	2-18
Floor plates	4-58	4-29
Forms and records	1-2	1-1
Front wheels	4-53	4-27
Front wheel lean control housing inspection	3-15	3-6
Fuel filter assembly	4-17	4-10
Fuel lines and fittings:		
Replacement	4-19	4-11
Service	3-10	3-3
Fuel primer pump	4-16	4-9
Fuel system:		
Extreme cold	2-14	2-17
Extreme dust and sand	2-16	2-18
Extreme heat	2-15	2-17
Fuel system components	3-10	3-3
Fuel tank	4-18	4-10
Fuel transfer pump	4-15	4-8

G

General:		
Controls and instruments	2-8	2-4
Lubrication instructions	3-2	3-1
Operation under usual conditions	2-10	2-9
Preventive maintenance checks and service	3-4	3-1
Troubleshooting	3-6	3-2
General maintenance	4-5	4-1
General maintenance of:		
Air induction system	4-20	4-11
Brakes	4-48	4-24
Cooling system	4-24	4-13
Earthmoving equipment	4-67	4-33
Electric system	4-32	4-16
Front axle	4-42	4-21

Hood	4-56	4-30	Power control housing:	4-76	4-41
Hydraulic junction	4-62	4-30	Maintenance	3-24	3-10
Hydraulic oil filter	4-61	4-30	Service		
Hydraulic oil tank:			Power control worm and gear housing:		
Removal	4-66	4-32	Maintenance	4-77	4-41
Service	3-23	3-9	Service	3-25	3-10
Hydraulic pump	4-65	4-32	Preventive maintenance	3-5	3-1
			Preventive maintenance services	4-6	4-1

I

Identification and tabulated data	1-7	1-3			
Inspecting and servicing the equipment	2-1, 4-1	2-1, 4-1			
Inspection:					
Brake master cylinder	3-21	3-9			
Equipment	4-1	4-1			
Fan belt	4-29	4-15			
Front wheel lean control housing	3-15	3-6			
Maintenance of engine	3-7	3-2			
Radiator	3-12	3-6			
Installation	2-2	2-1			
Instruments and controls	2-9	2-4			
Interference suppression components	4-9	4-3			

L

Lean control housing:					
Inspection	3-15	3-6			
Service	4-47	4-24			
Leaning wheel tie bar	4-44	4-22			
Lubrication:					
Detailed instructions	3-3	3-1			
Extreme cold	2-14	2-17			
Extreme dust and sand	2-16	2-18			
Extreme heat	2-15	2-17			
General instruction	3-2	3-1			

M

Movement to a new worksite:					
Driving	2-5	2-3			
General	2-4, 4-2	2-3, 4-1			
Shipping	2-7	2-3			
Touring	2-6	2-3			

O

Operation:					
Fire extinguisher	2-20	2-18			
High altitudes	2-19	2-18			
In dust or sand	2-16	2-18			
In extreme cold	2-14	2-17			
In extreme heat	2-15	2-17			
Of equipment	2-13	2-9			
Rainy or humid conditions	2-17	2-18			
Salt water areas	2-18	2-18			
Oil cooler	4-31	4-15			

P

Parking brake:					
Adjustment	3-20	3-8			
Removal	4-49	4-24			
Parking brake linkage and lever	4-49	4-24			
Pedal and linkage, brake	4-13	4-5			
Pintle	4-55	4-29			

R

Radiator:					
Replacement	4-26	4-13			
Service	3-12	3-6			
Rear axle housing	3-17	3-7			
Relief valve	4-64	4-31			
Replacement:					
Air cleaner	4-21	4-11			
Alternator	4-33	4-16			
Battery	4-35	4-18			
Bevel pinion case	4-72	4-38			
Blade assembly	4-79	4-42			
Blade lift controls	4-68	4-33			
Blade sideshift control valve	4-63	4-31			
Brake master cylinder	4-51	4-27			
Brake pedal and linkage	4-52	4-27			
Circle centershift controls	4-69	4-36			
Circle reuse gear housing	4-70	4-37			
Crankcase breather	4-12	4-4			
Drive shafts and universal joints	4-73	4-38			
Engine side panels	4-57	4-29			
Exhaust manifold	4-22	4-12			
Exhaust pipe and muffler	4-23	4-12			
Exterior lights	4-36	4-18			
Fan	4-28	4-14			
Fan belts	4-29	4-15			
Floor plates	4-58	4-29			
Front wheels	4-53	4-27			
Fuel filter assembly	4-17	4-10			
Fuel lines and fittings	4-19	4-11			
Fuel primer pump	4-16	4-9			
Fuel tank	4-18	4-10			
Fuel transfer pump	4-15	4-8			
Hood	4-56	4-29			
Hydraulic oil filter	4-61	4-30			
Hydraulic junction	4-62	4-30			
Hydraulic oil pump	4-66	4-32			
Hydraulic pump	4-65	4-32			
Leaning wheel tie bar	4-44	4-22			
Oil cooler	4-31	4-15			
Parking brake linkage and lever	4-49	4-24			
Pedal and linkage	4-13	4-5			
Pintle	4-55	4-29			
Power control drive shaft	4-74	4-39			
Radiator	4-26	4-13			
Relief valve	4-64	4-31			
Scarifier assembly	4-80	4-43			
Scarifier teeth	3-31	3-11			
Shift control linkage	4-39	4-20			
Starting motor	4-34	4-17			
Steering arm	4-46	4-23			
Steering knuckle and leaning wheel-arm	4-43	4-21			
Tie rod	4-45	4-23			
Tires	4-54	4-28			
Transfer gear housing	4-71	4-37			
Water pump	4-27	4-14			

Official:

W. C. WESTMORELAND,
*General, United States Army,
Chief of Staff.*

KENNETH G. WICKHAM,
*Major General, United States Army,
The Adjutant General.*

Distribution:

To be distributed in accordance with DA Form 12-25, Sec II (qty rqr Block # 394), Organizational maintenance requirements for Earth Moving Equipment: Graders.

